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ABSTRACT

This series of six papers concerning the Beginning Teacher Evaluation Study (BTES) starts with Teaching Behaviors, Academic Learning Time and Student Achievement: An Overview of Phase III-B of the Beginning Teacher Evaluation Study by the project director, Charles Fisher. As an introduction, it describes a model of classroom instruction based on the concept of student academic learning time (ALT) as a function of student entering characteristics (aptitude), and teaching behaviors and other classroom context variables. More precisely, ALT is student engagement time with relevant tasks which have a low error rate for that student. The remaining papers were: Methodological Issues and Concerns in Research on the BTES Classroom Learning Model by Leonard S. Cahen; Academic Learning Time and Achievement: The Validation of a Measure of Ongoing Student Engagement and Task Difficulty by Richard Marliave; How Teachers Produce "Academic Learning Time": Instructional Variables Related to Student Engagement by Nikola N. Filby; Changing Academic Learning Time: Clinical Interventions in Four Classrooms by David C. Berliner; and An Analysis of Instructional Time in Grade 4 Mathematics by Cahen and Fisher. An annotated bibliography of 57 documents related to the BTES is appended. (CTM)

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BTES

BEGINNING TEACHER EVALUATION STUDY

SUPPLEMENT

BEST COPY AVAILABLE

SELECTED FINDINGS FROM PHASE III-B

by

Charles Fisher
Leonard S. Cahen
Nikola N. Filby
Richard Marliave
David C. Berliner

May, 1978

PRELIMINARY VERSION

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PREFACE

The Beginning Teacher Evaluation Study examined instructional factors which foster student learning from elementary school instruction in the basic skills. This major study was sponsored by the California Commission for Teacher Preparation and Licensing and funded by the National Institute of Education. The empirical work associated with the study was carried out in separate phases by subcontractors. Phase III of the BTES was conducted by the Far West Laboratory of Educational Research and Development.

The BTES culminated in a field study designed to evaluate the Academic Learning Time model of classroom instruction. This work completed by the Far West Laboratory is fully described in a series of technical reports (see Appendix A).

As part of a separate grant from the National Institute of Education to the Far West Laboratory, a series of six papers on Phase III-B of the major study were developed. These papers are intended for a general educational research audience.

Charles Fisher
Project Director
Beginning Teacher Evaluation
Study Supplement
May, 1978

Teaching Behaviors, Academic Learning Time and Student Achievement: An Overview of Phase III-B of the Beginning Teacher Evaluation Study

by
Charles W. Fisher
Far West Laboratory for Educational
Research and Development

Teaching Behaviors, Academic Learning Time, and Student Achievement: An Overview of Phase III-B of the Beginning Teacher Evaluation Study

Introduction

The overall objective of the Beginning Teacher Evaluation Study[1] is to provide knowledge and insight into the process by which students learn basic skills in elementary schools. The study is being conducted in sequential phases wherein each phase builds upon the previous phases. In earlier phases of the study, field research was carried out in a number of areas to generate hypotheses and develop appropriate instrumentation.[2] As a result of this work, and careful review of research on the effectiveness of instruction, a model of classroom instruction was constructed.

An important feature of this model is student academic learning time. This construct is defined as the amount of time a student spends engaged on a task that produces few student errors and which is directly related to a defined content area. In brief, the model states that student achievement is a function of academic learning time and student entering characteristics; and that, academic learning time is influenced directly by teaching behaviors and classroom context variables. The papers in this set describe portions of the work completed during Phase III-B of the Beginning Teacher Evalaution Study. The underlying goal of the work is to

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[1]The Beginning Teacher Evaluation Study is funded by the California Commission for Teacher Preparation and Licensing and the National Institute of Education.

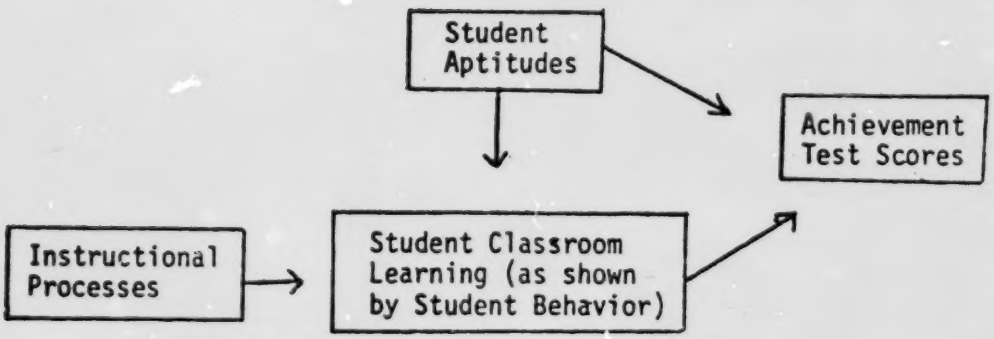
[2]Descriptions and results of some of the earlier work on BTES are presented in McDonald and Elias (1976); Berliner (1975); Berliner, Filby, Marliave, Moore, and Tikunoff (1976); Filby and Dishaw (1976); Fisher, Marliave, Filby, Cahen, Moore, and Berliner (1976a, b); Marliave (1976); Marliave, Fisher, Filby and Dishaw (1977); Morine and Vallance (1975, 1976); and Tikunoff, Berliner, and Rist (1975), among others.

examine the utility of the academic learning time model for explaining differences in student learning.

Many studies of teaching have related teaching behaviors directly to student achievement test scores. Such a model ignores the learning process itself. Student learning takes place in individual student minds as they work in classrooms throughout the school year. Achievement test scores provide one imperfect, distal measure of that learning. Student learning behavior in the classroom should provide a more immediate indicator of learning as it takes place. Instructional process variables, then, influence not achievement test scores, but student learning in the classroom, over time. A diagram of this model is shown in Figure 1.

Figure 1

The General Model of Instruction



Academic Learning Time (ALT)

In the BTES project, student classroom learning has been operationally defined as Academic Learning Time (ALT). Student learning in its purest form is unobservable. It is an ongoing cognitive process that takes place in the brain. Some observable manifestation of learning is needed. Achievement scores represent one measure of accumulated knowledge and/or skill. In the BTES study, we have tried to get a more immediate measure of learning by observing student behavior in the classroom. Essentially, we hypotnesize that accumulated learning time can be used as a surrogate measure of amount of learning. Academic Learning Time (ALT) is defined as time spent by a learner engaged in a task on which relatively few errors are produced where the task is related directly to an academic outcome. Thus, the three basic components of ALT are student engagement, student error rate, and task relevance to an academic outcome.

Engagement refers to the involvement of the student in the learning activity under consideration. Obviously, no student learning can occur if there is no engagement. Therefore, the distinction between student engaged time and teacher allocation of time is critical. Allocated time is a function of teacher behavior, the assignment of a given activity to a specified period of student time. This is important, in that, it generally sets the limit for student engaged time in that particular activity. Nevertheless, there maybe vast differences between allocated time and student engaged time. These differences may occur generally for an entire class or differentially across students within a class. Because student engagement in a learning activity is a necessary precondition for learning, ALT must include only engaged time.

Student error rate must be determined in relationship to the individual student. A given task will range from excessively easy to impossibly difficult, depending upon the student for whom the task's difficulty is being determined. For a given student the error rate associated with a task maybe thought of in three categories. On some tasks, students make relatively few mistakes and the activity is relatively easy for the student. This kind of situation has a low error rate for the student. On other tasks, the student may make about as many correct responses as incorrect responses. Such tasks are characterized as having medium difficulty for the student.

On still other tasks, the student will make correct responses at about the chance level. In this situation, the task is described as having a high error rate for the student. Tasks with low error rates provide situations where a student has a relatively clear understanding of the task and is able to perform it with some effort. Less than minimal comprehension (high error rate) precludes learning because the student is not ready to even begin learning the task. Time spent on tasks with low error rates provide situations where students can rapidly improve their performance and continue to learn as tasks with small increases in difficulty are encountered. Hence academic learning time includes that time which a student spends engaged on tasks with low error rates. This does not necessarily mean that students should never attempt somewhat more difficult tasks. For the purposes of this model, more time on tasks with low error rates than on tasks with medium and high error rates will enhance learning. In more complex models, it maybe that some combination of time on low and medium error rate tasks maybe appropriate.

Task relevance to an academic outcome simply identifies the content category to which ALT is directed. A particular study might focus on a narrow range of content outcome categories, and therefore a narrow range of ALT. Clearly, if one attempts to relate ALT to gain on an achievement test battery, then ALT must be limited to those content categories that are relevant to that battery. The present study is limited to ALT involving tasks that are relevant to reading and mathematics outcomes. We are not assessing the effects of ALT for other academic outcomes. Conceptually, however, ALT could be applied to any academic outcome.

The absence of ALT is also important. A great deal of student time in class consists of "Non-ALT" because the student is not engaged in any academic task or because the academic task in which the student is engaged has an inappropriate difficulty level. The usefulness of the concept, "Non-ALT", lies in the specification of its cause, either lack of engagement or an unreasonable level of task difficulty. Hence, it is possible to analyze in terms of student variables <u>why</u> learning does not occur.

A major strength of the ALT concept is that it focuses on an individual student and his ongoing learning behaviors. The model is remarkably flexible, in that, a teacher may keep track of engagement and difficulty for groups or for the whole class by "averaging" over individual students. However, the major advantage of the model is that it helps a teacher really "see" what individual students are doing in terms of their observable classroom learning behaviors. The power of this perspective lies in the fact that learning is really an individual phenomenon, not a group phenomenon. Therefore, while managing the class as a group, the teacher must have some perspective with which the ongoing learning of individual students can be monitored.

Instructional Processes

ALT represents a proximal measure of student-learning-as-it-occurs. The instructional processes that result in increased student ALT, will also yield increased student learning. Therefore ALT is central to the instructional process, and serves as the basis of the present analysis of teaching behaviors.

The teaching behaviors that influence ALT can be conceptualized in terms of five interrelated functions (diagnosis, prescription, presentation, monitoring, and feedback) that occur through time in a roughly cyclical fashion, as shown in Figure 2.

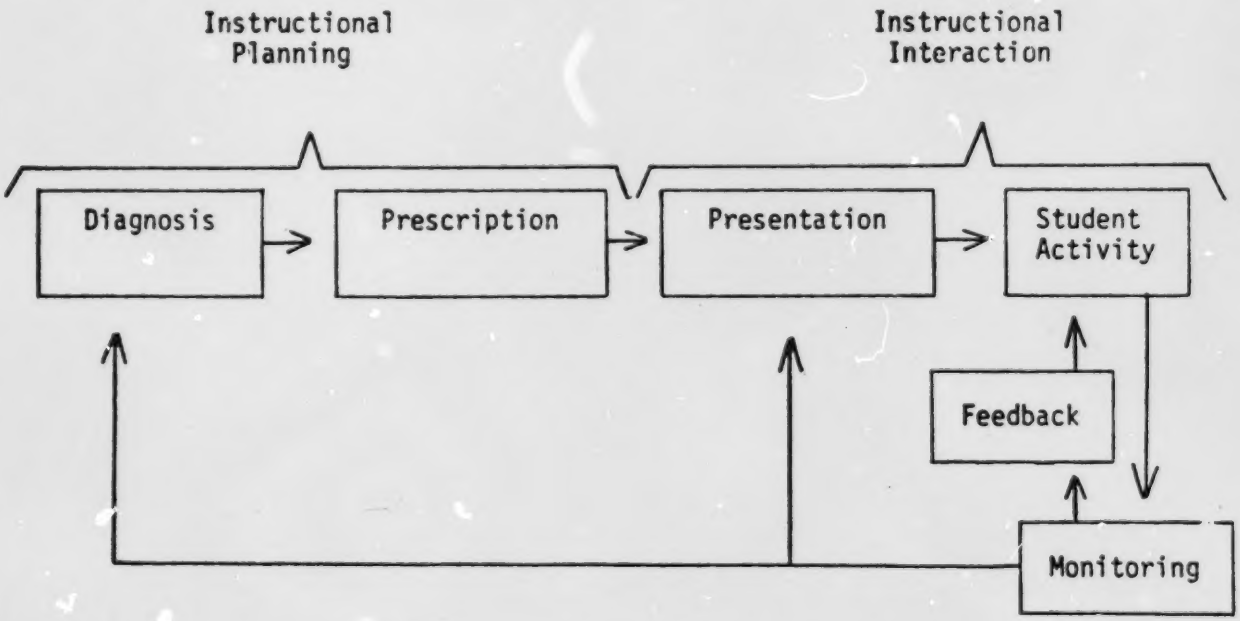


Figure 2

Schematic Configuration of Instructional Functions in the Academic Learning Time Model

Depending upon the class organization and curriculum characteristics, the functions in the basic cycle maybe satisfied by apparently very different behaviors. Monitoring in a large group discussion is very different from monitoring during seatwork. In the first case, monitoring is implicit in the process we call discussion. In the second case, monitoring may or may not be performed by the teacher at any given time. Similarly, individual teachers may vary in the behaviors with which they fulfill these functions.

The cycle of functions begins with a planning phase. The teacher as organizer and decision-maker assesses the current knowledge, skill levels, strengths, and weaknesses, of his students (diagnosis). He can then decide on appropriate instructional activities and methods for reaching those goals (prescription). These decisions set the stage for the instructional interaction phase.

The interaction phase begins with the presentation of concepts or learning tasks to the student. The student responds to this input in some way, with an overt action, with a covert assimilation of information, or by ignoring the input. The teacher monitors the student's responses in order to know whether the instructional goal is being achieved. Monitoring tells the teacher about the student's state of knowledge or skill following an instructional presentation. Guided by information from monitoring, the teacher may provide feedback to the student, provide additional explanation or cycle back to the beginning for further diagnosis and planning.

The focus on the teacher as a conscious or intuitive decision-maker occurs throughout this cycle. The teacher arrives at goals, presents instruction toward those goals, and evaluates whether or not the goals

are being reached. He decides whether a student's response is adequate or inadequate, and decides, on the basis of the student's response, what to do next.

ALT provides the vehicle for monitoring the impact of this instructional process. Each of the functions in the model contributes directly to establishing or maintaining ALT. Accurate diagnosis and prescription enable the teacher to assign tasks of an appropriate difficulty level for the student, in a content area that is relevant to the student's needs. Presentation that is well structured, clear, and relevant to student needs results in greater student understanding of the task. This, in turn, produces higher engagement and a more reasonable difficulty level. Monitoring and feedback maintain student engagement and understanding of the task, and allow the teacher to rediagnose and represcribe when appropriate. An examination of ongoing instruction in terms of student ALT and related teaching functions allows one to identify when and where the student learning process is being interrupted, relating these interruptions to instructional functions.

This model or conceptual framework has a number of important characteristics. The central role in the model is given to academic learning time. By doing so, the model begins to "unpack" the complex relationships between teaching behaviors and student test scores. Academic learning time provides an index of ongoing student learning as it occurs.

Another advantage of the ALT concept lies in the fact that it is coextensive in time with instruction itself. In this way it provides a proximal student variable against which assessments of ongoing classroom conditions and behaviors can be made. The feedback value to a teacher, provided by ALT, is potentially very great. An awareness of the ALT

for an individual student or the profile of ALT across the students in a class may allow a teacher to decide not only when to intervene on an instructional sequence but also provide strong indicators of what to change.

This is an important point since, this framework provides an observable in-class criterion which can guide minute to minute instructional decisions.

This model also conceptualizes teaching behaviors in terms of the functions they serve in the instructional setting. When teaching behaviors are defined at a very molecular level, it is extremely difficult to show stability in the impact of the behavior over even relatively small changes in context. It appears that the same behavior can serve different functions depending upon the context. This implies, for example, that there is no one specific behavior which will turn out to be the essential performance of the monitoring function. This functional view of teaching behavior seems to me to have remarkable potential for conceptual elaboration and especially for the practice of teaching. Certainly teachers need a repertoire of specific teaching behaviors, but they must also have a good grasp of the functions which specific behaviors fulfill. These are some of the issues which come to mind when considering the academic learning time model.

Overview of Design for Phase III-B

The design of the Phase III-B study called for student outcome measures to be collected at three points in time with extensive collection of instructional process information during the inter-test periods. The outcome measures covered specific content areas in reading and mathematics. Data were collected during the 1976-1977 school year (with follow-up achievement testing in September, 1977) on two samples of students--one at grade 2

and one at grade 5.

Instructional process data were collected by a trained field staff during the two major inter-test periods. The first or A-B period began with the "A" test administration in October, 1976 and ended with the "B" test administration in early December, 1976. There were six weeks between the "A" and "B" test points. The second or B-C period began with the resumption of school in January, 1977 and ended with the "C" test administration in April, 1977. The B-C period spanned 17 weeks and together with the A-B period provided 23 weeks of instructional process data. Extensive process data were not collected after the "C" testing occasion.

The BTES achievement battery containing approximately 25 subtests in mathematics and reading was administered by our field staff at each of the three major testing occasions. Subscale scores for each student constituted the achievement data for Phase III-B.

Information on allocated time was obtained via daily teacher logs, wherein teachers reported time allocated to specific content areas for individual students. A specially designed observation system provided information on student engagement and student error rates. Each student in the study was observed one day per week, on the average, throughout the major inter-test periods. Allocated time from teacher logs and engagement and error rates from direct observation constituted the academic learning time data.

Interactive teaching behaviors (presentation, monitoring, and feedback) were also assessed for individual students via the direct observation procedure. Preactive teaching behaviors (diagnosis and prescription) were assessed by interviews, ratings and questionnaires. These data constituted the information on teaching behaviors.

In addition to these three major clusters of variables (achievement, ALT, and teaching behaviors) we also collected information on classroom climate, classroom setting variables, student attitudes, and student background characteristics.

Teachers to be included in the study were recruited during the spring of 1976. All teachers participating in the study were volunteers.

In order to minimize ceiling and floor effects on repeated achievement testing, and to allow collection of process data on individual students our design prescribed the selection of target students within each class. This selection was carried out by administering a representative battery of reading and mathematics subscales to each student in the volunteer classes. From the distribution of scores for each grade we established a relatively homogeneous band from which to identify target students. On the basis of this achievement information and teacher feedback, we identified three boys and three girls in each class. The final sample for the study consisted of 139 target students in 25 grade 2 classes and 122 target students in 21 grade 5 classes.

Data analysis on Phase III-B is ~~approximately 80%~~ completed at this time. The papers in this set report a number of our results, ~~to date.~~ The final report entitled Teaching behaviors, academic learning time and student achievement: Final report of Phase III-B, Beginning Teacher Evaluation Study (Fisher, Filby, Marliave, Cahen, Dishaw, Moore, and Berliner) will be available in June, 1978.

The next paper, by Leonard Cahen, will describe a number of methodological issues which arose in the course of the study. His paper is entitled Methodological issues and concerns in research on the BTES classroom learning model.

The model maybe thought of in terms of two major links. One link traces the influence of teaching behaviors on student academic learning time and the second link focusses on the relationship between academic learning time and student achievement. The next two papers describe our work on these two links of the model. Richard Marliave's paper is entitled Academic learning time and achievement: The validation of a measure of ongoing student engagement and task difficulty. Nikola Filby's paper, How teachers produce "academic learning time": Instructional variables related to student engagement, presents information on the second link of the model.

A subsample of teachers in the grade 2 sample also participated in an intervention study. In these classes BTES staff worked closely with individual teachers in designing and carrying out classroom interventions based on the academic learning time model. David Berliner discusses this work in his paper Changing academic learning time: Clinical interventions in four classrooms.

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Methodological Issues and Concerns in Research on the BTES Classroom Learning Model

Leonard S. Cahen

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Today I will try to cover some of the conceptual and methodological issues that have confronted our BTES staff over the past four years. I will primarily focus on issues and problems that faced us during the data gathering year that ended about 6 months ago. Charles Fisher has already provided you with a sketch of the past year -- grade 2 and 5 pupils participating with us -- records of instructional time allocation in reading and mathematics -- data from classroom observation and teacher interviews -- and assessment of pupil growth in achievement and affect. I gratefully acknowledge ideas and input from my colleagues as to their perceptions of the problems and issues encountered on our four year journey together. Errors, omissions, and biases reported here are mine, however.

BTES was originally conceived as a policy study by the California Commission on Teacher Preparation and Licensing. Information was sought about teacher behaviors, characteristics and skills that were related to pupil growth in achievement. If these teacher characteristics could be identified, information would be available to help evaluate curricula for teacher training in California. An explicit set of questions that the study was to answer have never appeared. However, through frequent interactions with key members of the Commission, and their advisory panels, plus our sense of what questions were important, a set of directional guidelines were established. This activity would have to be called interactive -- we presented our ideas and plans, responded to suggestions and questions from reviewers, we modified our plans, etc. The term policy research is frequently used these days. Further understanding of what policy research is, and can be, is required.

I will now move to a set of topics or question areas that hopefully will illustrate some of the general and specific points I would like to make.

1. Inquiry Approaches / Generalizability and How to Find Out!

During the planning activities of the final year long phase we carefully weighed the strengths and weaknesses of experimental approaches versus a correlational study. We met with advisory panels formed by the Commission. Each approach had its advocates. Experimentation always sounds like the answer but in addition to practical concerns we had to know much more than we did about the nature of the dimensions worthy of experimental control and manipulation. We hoped we would be better able to identify these dimensions or variables after conducting a study in natural classrooms. We next made a decision to keep the number of sampling units i.e., classes, small. We decided to trade off large numbers of classes for more intensive information about what happened in these classes -- to pupils and to teachers. We learned that "small" is not necessarily small as the late E.F. Schumacher might have told us. The strategy of intensive investigation with smaller number of classes still seems to me to be a good strategy. We were confronted with problems at the analyses stages, however, when we had a very large number of measures in proportion to the number of sampling units. This situation does not bear well when one relies on linear models for data analysis. I will return to some analysis issues later.

Our research was conducted in classes where teachers had volunteered to participate. David Berliner (Berliner, 1975) has pointed to some of the problems of generalizability when one works with volunteer groups of teachers.

Another generalizability concern we share focuses on the nature of the BTES pupil population. Rather than attempting to assess or follow all of the students in the classes chosen to participate, we decided to

select 6 students in each class for intensive observation and assessment. The 6 students were selected on scores on an achievement test we designed. We were aware of problems from the previous year where many students made very high scores on the spring testing sessions (the problem of ceiling effects) and through the use of an actuarial approach we selected the 6 students in each class from score ranges that projected low probabilities of "ceiling" on our tests during the winter and spring testing sessions. Again we see a tradeoff -- selecting students who had room to show growth on test scores but who were typically slightly below the average of all the students we tested in September. We must wonder whether our findings would replicate if we worked with lower or higher ability pupils.

A third generalizability issue revolves around the problems of the classroom observation of teachers and pupils. One might call this issue sampling density. How could we best schedule field workers/observers? Was a once a week observation schedule adequate? Should a field worker be regularly assigned to observe in only a few of the classes, thereby getting to better "see" what the teacher is doing and what is happening to the 6 pupils, or should we establish an observation schedule that gets each observer into more classes, thereby averaging out any particular observer bias?

2. Problems of Definitions and Conceptions

One of the continuing concerns we have is the issue of quantity of instruction time and quality of instruction. I doubt that anyone would support the position that 2 students each receiving 10 minutes of instruction in place value have received the "same" or "equal" instruction. What defines quality instruction? That is one thing I would like to know.

We have attempted to improve our definition of academic learning time by correcting allocated time for differences in pupil engagement rates and error rates.

We also searched long and hard for meaningful definitions of appropriate teacher behavior. The concept of appropriateness must be part of a search for the understating of quality instruction. The idea of appropriate teacher behavior (we later hedged by renaming it reasonable) is central to the concept of individualized instruction. If, -- a teacher can make professional diagnoses and prescriptions for each pupil and get the pupil engaged on tasks of the appropriate difficulty level and content we believe the pupil will learn.

3. Analysis, Interpretation and Problems

Earlier I mentioned that our decision to study in depth a few classes and a limited number of pupils (139 at grade 2 and 122 at grade 5) created a vast number of variables in proportion to the number of pupils. The number of possible independent dependent variables number in the hundreds. We reduced the number to about 50 for our final set of analysis runs. The conceptual and methodological issues concerning how one combines or aggregates measures deserves more than the passing comment it is receiving here. We were primarily committed to regression approaches to answer the following questions. If one defines a residualized achievement gain score by sweeping a pre-measure out of a post-measure, what are the correlates of the residual? What is the correlation of the residual to different measures of academic learning time, teacher behavior, etc. To further frustrate us we had a mixture of variables -- measures at the pupil level and measures at the class (or teacher) level (such as measures obtained from ratings). In the latter case the rated teacher measure

became a constant for each of the 6 pupils in the class. An array of concerns emerged as we attempted to analyze the matrices of mixed measures. One concern focused on the problem of a large set of independent variables to the number of sampling units. How would expected "shrinkage" affect the parameter estimation of the contribution of time, teacher behaviors, etc. How would the parameters of interest to us be affected by a mixture of individual and class mean measures? Lastly, if one feels obligated to report levels of significance of the statistical estimates of parameters, what are the appropriate degrees of freedom to check probability levels of chance findings?

An alternative, or I should say, as a complimentary approach to grinding out the regression weights, variance accounted for, etc., we attempted to plot and examine three dimensional plots of data. We found this technique to be helpful, but not efficient. Given more time we would have liked to do more data analysis (plotting, etc.) to compliment the statistical analyses. David Wiley (Wiley, 1978) in his review of John Tukey's Exploratory Data Analysis, talks about the revolution currently shaking the field of statistics. Wiley lists the following reasons for the growing use of data analysis:

1. the assumptions necessary to assure the utility of traditional statistical techniques are so seldom met that these techniques should never be routinely used;

2. for a given category of problem, there is no single best technique and there never will be;

3. there is much to be found in any data set which cannot be anticipated; and

4. a summary picture is worth a thousand summary numbers.

As one added point, it has been our experience that achievement gains are usually small, even though we hope for, and expect, large gain scores. We also note great variability on gain scores and on many other variables. When classical statistical testing takes place differences are swamped by their standard errors. As each year passes I wonder, with greater curiosity, why we continue to use classical statistical testing as the primary quantitative tool in grasping for truth about the world we research.

Some Closing Remarks

Conducting research in classrooms requires great cooperation and organization. The teachers who allowed us to share their classrooms deserve special credit. They filled out weekly logs for us, participated in interviews, etc. During the course of the year we lost one teacher to pregnancy, two to heart attacks and one teacher died! BTES research is only for the hardy!

We must gain more experience in establishing realistic time lines to perform field research. Deadlines are established and frequently they are recognized as unrealistic, but only when it is too late. Sufficient time to explore and play with data, reflect on preliminary findings, modify the next analysis phases, etc. is required. There is a disease currently spreading throughout the country -- from Washington, and in our case, Sacramento. It is called DISSEMINATION PRAECOX (premature dissemination)! To the naive, dissemination is logical and obvious. To the researcher, a dilemna exists -- how does one tell the sponsors that the research findings are speculative, needing replication, etc. without convincing the sponsors that they have been shortchanged.

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Academic Learning Time and Achievement: The Validation of a Measure of Ongoing Student Engagement and Task Difficulty

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ABSTRACT

Academic Learning Time and Achievement: The Validation of a Measure of Ongoing Student Engagement and Task Difficulty

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A model of Academic Learning Time (ALT) is described, where ALT represents ongoing student learning in terms of student engagement, low student error rate, and relevance of the instructional task to the specified outcome. This model was validated in a correlational study of the relationship between these variables and student achievement. Data were collected at second grade (139 students in 25 classes) and fifth grade (122 students in 21 classes). Reading and mathematics achievement tests were administered in December and again in April-May. ALT was measured during the inter-test period by direct observation and with records kept by teachers. Trained observers collected data for one full day each week in each class. These data were used to obtain student engagement rates, student error rates (low, medium, and high), and general correction factors for the teacher records. The teacher records were kept on a daily basis. These records provided data on the instructional time allocated to specific content areas within reading and mathematics.

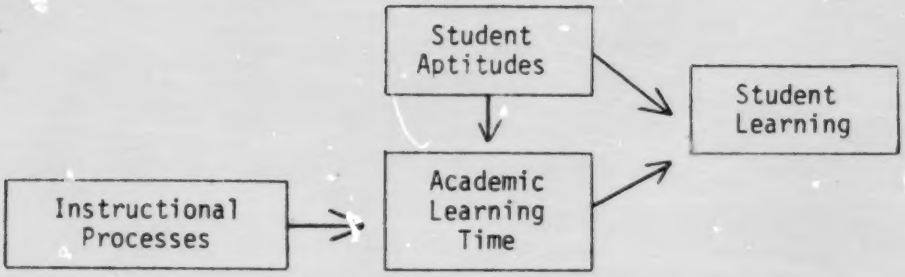
Multiple regression analyses were conducted, where posttest achievement scores were predicted by pretest scores, allocated time, engagement rate, low error rate, and high error rate. Analyses were conducted for total reading, total mathematics, and several subcategories within each of reading and mathematics. Allocated time, engagement rate, and low error rate were found to be positively associated with student learning, while high error rate was negatively associated ($p \leq .10$). Except for engagement rate at grade 2 mathematics and low error rate at grade 5 reading, these effects were consistent across both grade and content area. Furthermore, there was no case of a significant effect opposite in sign to that expected. The set of four ALT variables accounted for an average of about 11 percent of the residual variance in post achievement (after removing variance accounted for by pre achievement). In the strongest example, fractions at grade 5, the ALT variables accounted for 30 percent of the residual variance in achievement.

These analyses provide strong support for the relationship of ALT to student learning. This indicates that it is possible to measure ongoing student learning behaviors that are of considerable practical importance to both teachers and researchers.

Introduction

One of the major products of the line of research conducted for the Beginning Teacher Evaluation Study (BTES) has been a model of ongoing student learning, labeled academic learning time (ALT). It is intended that this model should describe classroom behaviors of students that manifest the ongoing occurrence of learning. Such a model, accompanied by instruments for measuring its component variables, should be a valuable tool for both educational practitioners and researchers. As portrayed in the schematic diagram below, the ALT model represents the link between instructional processes and student learning. This paper presents some of the major BTES findings relating ALT to student learning. The link between instructional processes and ALT is examined in an associated paper (Filby, 1978). A complete presentation of the BTES findings for instructional processes, ALT, and student learning will soon be available in the final report of the project (Fisher, Filby, Marliave, Cahen, Dishaw, Moore, and Berliner, 1978).

The findings to be presented here represent a first attempt to measure ongoing student learning behaviors, as represented by ALT, and to validate them against tests of achievement. Substantial support is demonstrated for the relationship between ALT and student learning. However, the BTES staff at Far West Laboratory believe that significant refinement of both the ALT model and its instrumentation are still warranted. The intent, here, is to show that learning in the form of ongoing student behaviors can be measured. Others are encouraged to contribute to the further elaboration of these behaviors and procedures for their measurement.



Schematic Overview of Academic Learning Time Model

Academic learning time (ALT). ALT involves engagement, low error rate, and task relevance to an academic outcome. Engagement refers to the involvement of the student in the learning activity under consideration. Obviously, no student learning can occur if there is no engagement. Therefore, the distinction between student engaged time and teacher allocation of time is critical. Allocated time is a function of teacher behavior, the assignment of a given activity to a specified period of student time. This is important, in that, it generally sets the limit for student engaged time in that particular activity. Nevertheless, there may be vast differences between allocated time and student engaged time. These differences may occur generally for an entire class or differentially across students within a class. Because student engagement in a learning activity is a necessary precondition for learning, ALT must include only engaged time.

Error rate on a task must be determined in relationship to the individual student. A given task will range from excessively easy to impossibly

difficult, depending upon the student for whom an error rate is being determined. In the ALT model, low error rate refers to a situation where the student produces only careless (or chance) errors. A moderate error rate involves a situation of partial knowledge, where the student understands enough to produce some correct responses, but also commits errors due to limitations in his/her understanding of the task. A high error rate is indicated when the student never responds correctly, except by guessing (a chance level of correct responses). Generally, it is expected that some balance between a low and a moderate error rate, with somewhat more activities at a low error rate than at a moderate error rate, will produce the most student learning. A high error rate would always be detrimental to learning conditions.

Task relevance to an academic outcome identifies the content category to which ALT is directed. A particular test might focus on a narrow range of content outcome categories, and therefore a narrow range of ALT. Clearly, if one attempts to relate ALT to gain on an achievement test, then ALT must be limited to those content categories that are relevant to that test.

The absence of ALT is also important. A great deal of student time in class consists of "Non-ALT" because the student is not engaged in any academic task or because the student's error rate on the task is excessively high. The usefulness of the concept, "Non-ALT," lies in the specification of its cause, either lack of engagement or an inappropriate student error rate. Hence, it is possible to analyze <u>why</u> learning does not occur.

A major strength of the ALT concept is that it focuses on an individual student and his ongoing learning behaviors. The model helps a teacher really "see" what individual students are doing in terms of their

observable classroom behavior. The power of this perspective lies in the fact that learning is an individual phenomenon, not a group phenomenon. Therefore, while managing the class as a group, the teacher must have some perspective for monitoring the ongoing learning of individual students.

Method

Data were collected on 139 second grade students from 25 classes and 122 fifth grade students from 21 classes. The classes of volunteer teachers were used. The student sample was obtained by selecting six students from each participating class on the basis of a selection test administered at the outset of the study. This test was designed to identify students of comparable entering achievement levels from each class so that the BTES achievement tests would be appropriate for all students in the study. Attrition, due to factors such as student absence during testing, resulted in an average of slightly less than six students per class.

Reading and mathematics achievement tests were administered to all participating students at the beginning of the school year (October, 1976), in early December, and at the end of the school year (April-May, 1977). These three testing occasions are referred to as A, B, and C, respectively. Extensive records of ALT were obtained during the inter-test periods by both observation and teacher record-keeping. This paper reports results from the second inter-test period (December to April), which is referred to as the "B-C period."

Observers were trained extensively over a three week period in the fall. Inter-observer reliability was established before data collection was initiated (Fisher, Filby, & Marliave, 1977). Two observers were assigned to each class and one full day of observation was conducted each week in each class throughout the inter-test periods.

Teachers were trained for record-keeping of allocated instructional time at an intensive one-day session before the study began (Dishaw, 1977). Evaluative tests were administered at the end of the day of training. Thereafter, the observers monitored individual teachers for their record-keeping accuracy during the course of the study. Corrective feedback was

provided where necessary.

Engagement rates were obtained for each student on the basis of observational data. Observers recorded the number of minutes that each student was engaged (paying attention) in reading or mathematics activities during a school day, as well as the amount of time that a student was not engaged. These data were used to compute the proportion of total time, in reading or mathematics, that a student was engaged over the course of the study (one day per week of observation data, combined for both of the inter-test periods). The determination of an overall engagement rate for each student provided assessment of engagement as a trait-like variable. The major purpose of this procedure was to increase the reliability of the variable (Marliave, Fisher, & Dishaw, 1977). As a result, two estimates of engagement rates were obtained for each student, one for reading and one for mathematics. No distinction was made between engagement during the two inter-test periods nor between engagement in any of the various content skill areas within reading or mathematics.

Error rates were also obtained for each student on the basis of observational data. Observers recorded the daily time, in minutes, that each student spent during reading or mathematics at each of the three error rate levels, low, medium, and high. Low error time was recorded when students were responding to a task with no errors other than careless mistakes (attributable to chance). Medium error was coded when students responded with a mixture of errors and correct responses, somewhere between the low and high error rate categories. High error was coded when students showed no correct responses, except what was attributable to guessing (a chance proportion of correct responses). The error rate data were compiled similarly to the engagement data, in that proportions of total reading or

mathematics time in each error category were computed over both inter-test periods combined. Again, this procedure was used to increase the reliability of the error rate estimates (Marliave, et al., 1977). This provided six estimates of error rate for each student: low, medium, and high in each of reading and mathematics. Analyses were conducted only for the low and high error rate variables, because the low and medium categories were essentially ipsative. (This was due to the fact that the high error category was a relatively rare occurrence, so that most activities fell into either the low or the medium error category.)

Records of allocated time within various skill and concept areas in reading and mathematics were obtained from teachers. These records were maintained on a daily basis for each student throughout the study. The observers also recorded allocated time within various content categories, but only during the single day of observation each week. However, observer records of allocated time were compared with teacher records on corresponding days. Observer-teacher allocated time ratios were computed for total reading time and for total mathematics time, across all the corresponding days for a given teacher. This ratio was applied to the teacher records of allocated time as a means of correcting them for general tendencies to over- or under-estimate total time in reading or mathematics (Marliave, et al., 1977).

The allocated time data, using the adjusted teacher records described above, were compiled for each inter-test period separately and for each of several skill and concept areas within reading and mathematics. Analyses showed that the teacher records of allocated time agreed satisfactorily with observer records, even before the adjustment (Marliave, et al., 1977). Furthermore, the teacher records covered every school day in each inter-test

period, so that they did not involve sampling as did the observational data (which were collected only one day per week). Therefore, it was not necessary to aggregate the allocated time data across the inter-test periods and across all the reading and mathematics categories, in order to obtain acceptable reliability.

Results

Descriptive data on ALT are presented in Table 1. Means and standard deviations are given for engagement rate, low error rate, and high error rate. Note that the average engagement rate for the B-C period was between 70 and 75 percent for both grades (2 and 5) and both content domains (reading and mathematics). One reason for these relatively high rates of engagement was the exclusion of transitional activities from allocated reading and mathematics time as recorded for this study. That is, time during which students were moving from one activity to another, or simply waiting for the next activity to begin, was excluded from the allocated reading and mathematics categories. This time might otherwise have been recorded as non-engaged reading and mathematics time. As discussed previously, teacher records of total reading and mathematics allocations were adjusted according to observer data. This adjustment assured that the exclusion of transitional activities from reading and mathematics allocations, for which the observers were carefully trained, was consistently applied to the teacher records of allocated time.

Table 1 also indicates that the high error rate category accounts for a very small proportion of instructional time, ranging from one to five percent. The low error rate category accounts for one-third to one-half of the remaining time. All other instructional time in reading and mathematics was coded as medium error rate (the only other category possible). Therefore, the low and medium error rates account for the vast majority of instructional time, so that these two categories are essentially ipsative (as discussed previously). For this reason, only one of these two categories, low error rate, was included in the analyses.

The relationship between ALT and student learning was analyzed with

Table 1

Descriptive Data

Academic Learning Time (B-C Period)

Grade	Content Domain	Proportion Engaged	Proportion Low Error Rate	Proportion High Error Rate
2 (N=139)	Reading	.74 (.10)	.50 (.18)	.02 (.03)
2 (N=139)	Mathematics	.70 (.12)	.50 (.21)	.05 (.07)
5 (N=122)	Reading	.75 (.11)	.46 (.15)	.01 (.02)
5 (N=122)	Mathematics	.73 (.13)	.34 (.21)	.03 (.06)

Entries are: Mean (Standard Deviation)

multiple regression techniques. Student achievement at the end of the school year (the C testing) was predicted by B test scores (in December), allocated time during the B-C period, engagement rate, low error rate, and high error rate. Analyses were conducted on all students pooled (for students at grades 2 and 5 separately).[1] Twenty-nine regressions were conducted.

The results of these analyses are presented in Tables 2 through 5. These four tables represent grade 2 reading, grade 2 mathematics, grade 5 reading, and grade 5 mathematics respectively. Each table has the same format. Each row presents information on one multiple regression. The content categories for post achievement, pre achievement, and allocated time are presented in the first three entries of a row (left side). The next four entries give the regression coefficients and associated probabilities for the four ALT variables (allocated time, engagement rate, low error rate, and high error rate). The sign of the regression coefficient indicates the direction (positive or negative) of the variable's effect on post achievement (C test). The probability associated with a coefficient indicates how likely it is that the effect is due to chance. The last seven entries in a row indicate what proportion of the variance in post achievement is accounted for by a given variable or set of variables. The first four of these give the unique contribution of each variable, while the fifth gives the joint contribution of all four ALT variables as a set. The next entry indicates how much post achievement variance is accounted for by the total regression (pre achievement and the four ALT variables,

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1. Additional analyses of ALT and student learning in the B-C period are reported in Technical Note V-1b (Marliave, Fisher, & Dishaw, 1978).

Table 2

Regressions Analyzing the Combined Effects of ALT Variables

Analyses of Reading Achievement in Grade 2 for the B-C Period, Regressing Post Achievement on Pre Achievement, Allocated Time, Engagement Rate, Low Error Rate, and High Error Rate (N=139).

Dependent Variable	Independent Variables Other than Engagement Rate, Low Error, and High Error		$\mathcal{B}$ as a raw coefficient Probability ≤ (in parentheses)				Proportion of Total Variance Accounted for Uniquely[a]						Residual Variance, Combined ALT Variables[d]
			Allo-cated Time	Engage-ment Rate	Low Error Rate	High Error Rate	Allo-cated Time	Engage-ment Rate	Low Error Rate	High Error Rate	Combined ALT Variables[b]	Total Regres-sion[c]	
Post Achievement	Pre Achievement	Time											
Total Comprehension	Total Comprehension	Total Comprehension	0.0005 (.77)	2.0 (.72)	5.1 (.12)	-10.0 (.59)	.00	.00	.01	.00	.02	.34	.03
Decoding Blends and Long Vowels	Decoding Blends and Long Vowels	Decoding Blends and Long Vowels	0.0033 (.02)	9.5 (.02)	5.0 (.05)	-31.7 (.02)	.02	.02	.01	.02	.09	.58	.17
Decoding Variant Consonants	Decoding Variant Consonants	Decoding Variant Consonants	0.0056 (.31)	4.7 (.25)	7.9 (.01)	-4.9 (.72)	.01	.01	.07	.00	.11	.23	.13
Word Structure Meaningful Units	Word Structure Meaningful Units	Word Structure Meaningful Units	0.0021 (.22)	1.3 (.69)	2.2 (.29)	-4.4 (.70)	.01	.00	.00	.00	.01	.50	.03
Syllables	Syllables	Syllables	0.0085 (.01)	1.3 (.59)	3.3 (.02)	-9.0 (.26)	.05	.00	.03	.00	.13	.22	.14
Decoding Complex Patterns	Decoding Complex Patterns	Spelling	0.0017 (.07)	5.1 (.10)	7.6 (.01)	-11.6 (.27)	.01	.01	.05	.00	.11	.58	.21
Total Reading	Total Reading	Total Reading	0.0013 (.33)	20.6 (.18)	22.1 (.03)	-87.3 (.10)	.00	.00	.01	.01	.04	.72	.11

[a] Given the five predictor model, this is the variance accounted for uniquely by the independent variable specified.

[b] The ALT variables are Allocated Time, Engagement Rate, Low Error Rate, and High Error Rate.

[c] This is the R squared for the multiple regression (the combined effect of Pre Achievement and the four ALT variables).

[d] "Residual variance" refers to the variance remaining in the Post Achievement measure after Pre Achievement is "removed." This column reports the proportion of this residual variance that is accounted for by the set of ALT variables.

Table 3

Regressions Analyzing the Combined Effects of ALT Variables

Analyses of Mathematics Achievement in Grade 2 for the B-C Period, Regressing Post Achievement on Pre Achievement, Allocated Time, Engagement Rate, Low Error Rate, and High Error Rate (N=139).

Dependent Variable	Independent Variables Other than Engagement Rate, Low Error, and High Error		B as a raw coefficient Probability ≤ (in parentheses)				Proportion of Total Variance Accounted for Uniquely[a]						Residual Variance, Combined ALT Variables[d]
Post Achievement	Pre Achievement	Time	Allocated Time	Engagement Rate	Low Error Rate	High Error Rate	Allocated Time	Engagement Rate	Low Error Rate	High Error Rate	Combined ALT Variables[b]	Total Regression[c]	
Addition and Subtraction No Regrouping	Addition and Subtraction No Regrouping	Addition and Subtraction No Regrouping	-0.0005 (.78)	1.7 (.72)	5.4 (.04)	-1.9 (.81)	.00	.00	.02	.00	.03	.28	.04
Speeded Tests	Speeded Tests	Speeded Tests	0.0148 (.02)	5.5 (.17)	11.0 (.01)	-0.9 (.89)	.02	.01	.09	.00	.14	.49	.22
Computational Transfer	Computational Transfer	Computational Transfer	0.0014 (.33)	0.3 (.93)	5.6 (.01)	1.3 (.85)	.00	.00	.03	.00	.04	.36	.06
Place Value and Numerals	Place Value and Numerals	Place Value and Numerals	-0.0010 (.67)	-2.9 (.43)	1.2 (.59)	-.58 (.37)	.00	.00	.00	.00	.01	.48	.01
Word Problems	Word Problems	Word Problems	0.0049 (.10)	0.4 (.90)	1.4 (.37)	-8.0 (.10)	.01	.00	.00	.01	.05	.32	.07
Money	Money	Money	-0.0005 (.78)	1.8 (.28)	1.7 (.09)	-6.6 (.02)	.00	.01	.01	.02	.08	.42	.12
Linear Measurement	Linear Measurement	Linear Measurement	0.0000 (.99)	0.2 (.86)	1.2 (.13)	-2.2 (.33)	.00	.00	.01	.01	.03	.22	.04
Fractions	Computational Transfer	Fractions	0.0126 (.01)	-0.6 (.81)	1.6 (.27)	2.0 (.66)	.10	.00	.01	.00	.10	.15	.11
Addition and Subtraction with Regrouping	Addition with Regrouping	Addition and Subtraction with Regroup-Algorithms	0.0046 (.04)	7.8 (.16)	5.1 (.11)	4.4 (.66)	.03	.01	.02	.00	.06	.12	.06
Total Math	Total Math	Total Math	0.0005 (.88)	15.3 (.33)	19.8 (.03)	-4.5 (.87)	.00	.00	.01	.00	.02	.61	.06

[a] Given the five predictor model, this is the variance accounted for uniquely by the independent variable specified.

[b] The ALT variables are Allocated Time, Engagement Rate, Low Error Rate, and High Error Rate.

[c] This is the R squared for the multiple regression (the combined effect of Pre Achievement and the four ALT variables).

[d] "Residual variance" refers to the variance remaining in the Post Achievement measure after Pre Achievement is "removed." This column reports the proportion of this residual variance that is accounted for by the set of ALT variables.

Table 4

Regressions Analyzing the Combined Effects of ALT Variables

Analyses of Reading Achievement in Grade 5 for the B-C Period, Regressing Post Achievement on Pre Achievement, Allocated Time, Engagement Rate, Low Error Rate, and High Error Rate (N=122).

Dependent Variable	Independent Variables Other than Engagement Rate, Low Error, and High Error		β as a raw coefficient Probability ≤ (in parentheses)				Proportion of Total Variance Accounted for Uniquely[a]						Residual Variance, Combined ALT Variables[d]
Post Achievement	Pre Achievement	Time	Allocated Time	Engagement Rate	Low Error Rate	High Error Rate	Allocated Time	Engagement Rate	Low Error Rate	High Error Rate	Combined ALT Variables[b]	Total Regression[c]	
Total Word Meaning	Total Word Meaning	Total Word Meaning	-0.0019 (.47)	23.6 (.01)	-0.4 (.92)	-30.8 (.31)	.00	.04	.00	.00	.05	.74	.15
Total Comprehension	Total Comprehension	Total Comprehension	0.0026 (.01)	-3.4 (.56)	-0.7 (.87)	-88.9 (.01)	.05	.00	.00	.02	.07	.74	.21
Syllables	Syllables	Syllables	-0.0016 (.73)	2.7 (.47)	-0.7 (.79)	-44.0 (.03)	.00	.00	.00	.03	.03	.38	.05
Total Reading	Total Reading	Total Reading	0.0014 (.12)	16.7 (.16)	-11.7 (.20)	-121.6 (.05)	.00	.00	.00	.01	.03	.79	.11

[a] Given the five predictor model, this is the variance accounted for uniquely by the independent variable specified.

[b] The ALT variables are Allocated Time, Engagement Rate, Low Error Rate, and High Error Rate.

[c] This is the R squared for the multiple regression (the combined effect of Pre Achievement and the four ALT variables).

[d] "Residual variance" refers to the variance remaining in the Post Achievement measure after Pre Achievement is "removed." This column reports the proportion of this residual variance that is accounted for by the set of ALT variables.

Table 5

Regressions Analyzing the Combined Effects of ALT Variables

Analyses of Mathematics Achievement in Grade 5 for the B-C Period, Regressing Post Achievement on Pre Achievement, Allocated Time, Engagement Rate, Low Error Rate, and High Error Rate (N=122).

Dependent Variable	Independent Variables Other than Engagement Rate, Low Error, and High Error		B as a raw coefficient Probability ≤ (in parentheses)				Proportion of Total Variance Accounted for Uniquely[a]						Residual Variance, Combined ALT Variables[d]
Post Achievement	Pre Achievement	Time	Allocated Time	Engagement Rate	Low Error Rate	High Error Rate	Allocated Time	Engagement Rate	Low Error Rate	High Error Rate	Combined ALT Variables[b]	Total Regression[c]	
Total Geometry	Total Geometry	Total Geometry	0.0016 (.52)	6.1 (.06)	-1.9 (.38)	-12.7 (.06)	.00	.03	.01	.03	.06	.18	.07
Total Multiplication	Total Multiplication	Total Multiplication	0.0007 (.50)	-1.4 (.64)	3.6 (.12)	18.7 (.01)	.00	.00	.01	.04	.07	.40	.11
Division	Division	Division	0.0010 (.30)	-4.1 (.22)	-0.5 (.82)	-19.3 (.01)	.01	.01	.00	.04	.06	.36	.09
Fractions	Fractions	Fractions	0.0027 (.01)	3.7 (.15)	-2.2 (.20)	-13.8 (.01)	.12	.01	.01	.03	.22	.50	.30
Computational Transfer	Computational Transfer	Computational Transfer	-0.0001 (.94)	-2.6 (.26)	2.9 (.06)	-12.4 (.01)	.00	.00	.01	.02	.04	.62	.10
Word Problems	Word Problems	Word Problems	-0.0007 (.58)	0.0 (1.00)	0.3 (.82)	-3.5 (.37)	.00	.00	.00	.00	.00	.38	.01
Multiplication Speeded Test	Multiplication Speeded Test	Basic Multiplication Facts	0.0096 (.08)	8.2 (.06)	5.7 (.05)	1.4 (.89)	.01	.01	.01	.00	.05	.69	.13
Total Math	Total Math	Total Math	0.0062 (.01)	1.5 (.89)	2.4 (.73)	-41.3 (.10)	.02	.00	.00	.01	.02	.72	.08

[a] Given the five predictor model, this is the variance accounted for uniquely by the independent variable specified.

[b] The ALT variables are Allocated Time, Engagement Rate, Low Error Rate, and High Error Rate.

[c] This is the R squared for the multiple regression (the combined effect of Pre Achievement and the four ALT variables).

[d] "Residual variance" refers to the variance remaining in the Post Achievement measure after Pre Achievement is "removed." This column reports the proportion of this residual variance that is accounted for by the set of ALT variables.

comprising a five variable set). The final entry in each row gives the proportion of "residual variance" accounted for by the set of four ALT variables, where "residual variance" refers to the variance remaining in post achievement after pre achievement is "removed."

When examining these four tables, it should be noted that the achievement and time content categories in the bottom row are always total reading or total mathematics. The preceding rows in each table always represent sub-categories of total reading or mathematics. Furthermore, the sum of the sub-categories is always equal to total reading or mathematics, as defined for this study.

The results for Tables 2 through 5 are summarized in Table 6. Each row in Table 6 summarizes the results for one of the four preceding tables. The first two entries in each row give the grade (2 or 5) and content domain (reading or mathematics) of the regressions summarized. The next entry gives the total number of these regressions. The next four entries give the number of significant regression effects and their sign (positive or negative) for each of the four ALT variables. The final entry in each row indicates the average proportion of "residual variance" accounted for by the set of four ALT variables in the regressions summarized.

The summary of results in Table 6 indicates that allocated time, engagement rate, and low error rate are each positively associated with achievement outcomes. High error rate is negatively associated with achievement. In no case was there a significant negative effect ($p \leq .10$) for time, engagement, or low error, nor a significant positive effect for high error. However, engagement in grade 2 mathematics and low error in grade 5 reading showed no significant effects. Nevertheless, the results are quite consistent overall. Furthermore, the set of ALT variables

Table 6

Summary of Regressions

Combined Effects of ALT Variables

Regression of Post Achievement on Pre Achievement, Allocated Time, Engagement Rate, Low Error Rate, and High Error Rate (B-C Period).

Grade	Content Domain	Total Number of Regressions	Number of significant effects ($p \leq .10$) positive + or negative -				Average Residual Variance, Combined ALT Variables[a]
			Allocated Time	Engagement Rate	Low Error Rate	High Error Rate	
2 (N=139)	Reading	7	3+	2+	5+	2-	.12
2 (N=139)	Mathematics	10	4+	0	5+	2-	.08
5 (N=122)	Reading	4	1+	1+	0	3-	.13
5 (N=122)	Mathematics	8	3+	2+	2+	6-	.11

[a] "Residual variance" refers to the variance remaining in the Post Achievement measure after Pre Achievement is "removed." This column reports the proportion of this residual variance that is accounted for by the set of ALT variables.

accounts for an average of about 11 percent of the "residual variance" in achievement. In the strongest example, fractions at grade 5 (Table 5), the ALT variables account for 30 percent of the "residual variance."

Summary and Conclusions.

The findings of this study show a strong and consistent effect of the ALT variables in relationship to student learning outcomes. These variables as a set, account for an average of about 11 percent of residual variance after pre-achievement is "removed." Furthermore, the effects are generally consistent across grade and subject matter, where allocated time, engagement rate, and low error rate show a positive relationship with learning, and high error rate shows a negative relationship with learning.

Simply put, it may be concluded that students who spend more time in an instructional activity, at a relatively high level of attention, and producing a relatively low number of errors, will learn more of the content of that instructional activity. It may also be concluded that about one tenth of the measured learning shown by students can be accounted for by data on their time, attention, and error rates.

It could be argued that the association of time, attention, and error rate with learning is an obvious one. One might futher contend that one tenth of student learning outcomes is a small effect. On the other hand, the conceptual clarity of the time, attention, and error rate relationship with learning could be seen as futher substantiation of the empirical relationships found. Educational relationships are much more believable it they are supported by good sense, as well as empirical data. Furthermore, the explanation of one tenth of student learning is surely of considerable importance. Any detectable portion of student learning is important, in relationship to the enormous impact upon society of the knowledge acquired by its members. In addition, It is most likely that this is an underestimation of the true effect of

the ALT variables upon student learning. Measurement in educational field research is known to suffer chronic inaccurracy, so that much of the unexplained variance in student learning is actually some form of error variance.[2] Thus, the true relationship between associated variables is generally much greater than their measured relationship.

A more fundamental point should be made on the results of this study. Ongoing student behaviors in the classroom have been shown to relate strongly and consistently to student learning outcomes. This represents a reasonably successful early attempt to measure the ongoing learning process itself. The measurement of ongoing learning is of considerable importance to teachers and researchers. It offers immediate feedback on the strengths and weaknesses of instructional events. It pinpoints those student behaviors (or the lack thereof) that obstruct learning. Furthermore, it allows for continuous monitoring of learning events without disrupting or actually displacing those events (as testing does).

ALT should be conceived more broadly than the particular variables measured here. Student attention to an instructional task is one variable in a cluster of affective-motivational student learning behaviors. Error rate is one variable in a cluster of cognitive student response variables. Allocated time in a content category is one variable in a cluster of dimensions characterizing instructional tasks. It is clear that considerable elaboration of the variables and instruments used in this study is both possible and desirable. The effectiveness of these variables and instruments in their current, rather simple, form is a promising indication of what might be attained by the measurement of student learning in terms of ongoing behavior in the classroom.

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2. See Boruch & Gomez (1977) for a full elaboration of this point.

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How Teachers Produce "Academic Learning Time": Instructional Variables Related to Student Engagement

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How Teachers Produce "Academic Learning Time": Instructional Variables Related to Student Engagement

One area of investigation in Phase III-B of the Beginning Teacher Evaluation Study is the relationship between teaching behavior in the classroom and student engagement. We know that student engagement is positively related to student performance on achievement tests. (See Marliave, 1978.) When students pay attention a greater percentage of the time, they learn more. Knowing this, the next question is what do teachers do to increase student engagement rates. This paper reports some tentative answers to this basic question.

The theoretical framework which guided the description of instruction was one of the function or role of a behavior in the instructional process. The general model of instruction guiding the BTES Phase III-B field study was described by Charles Fisher (1978). Five teaching functions are included in that model -- diagnosis, prescription, presentation, monitoring, and feedback. The first two functions, diagnosis and prescription, represent a planning phase. They were assessed for the BTES study through interviews, ratings, and teacher tests. The BTES model hypothesizes that teacher planning should have an effect primarily on student error rate rather than student engagement. Analyses of teaching behavior and student error rate are not included in this paper. Preliminary analyses have been reported in Filby and Cahen (1977, 1978).

The three interactive teaching functions are presentation, monitoring and feedback. During direct interaction with the student in the classroom, the teacher presents information to the student, checks to see what the student knows or has learned, and provides feedback to the student about how he is doing. Behaviors representing these three functions were

measured through extensive direct observation in the classroom. The BTES observation system was a time-based rotating-sample procedure. This classroom observation system recorded detailed information on the instructional day for individual target students. An event for each student was sampled about once every four minutes. Each event was coded along several dimensions. These dimensions included content of instruction, setting, student behavior (engagement and task difficulty) and the instructional behavior provided by teachers and other instructors.

Classroom observation took place for a full day approximately once each week. The academic year (1976-77) was divided into two major data collection periods, punctuated by student testing occasions. The A-B period covered about 6 weeks of instruction between the October ("A") and December ("B") testing occasions. The B-C period covered about 15 weeks of instruction from January through April, until the "C" testing in May. Most data reported in this paper come from the B-C period. The data reported are averages across about 15 days of observation in the B-C period.

The Interactive Teaching Behaviors

The interactive teaching behaviors that were observed are described in Table 1.

Insert Table 1 Here

Seven individual behaviors were coded. These behaviors represent aspects of the three interactive teaching functions. Notice that the behaviors can also be subdivided according to content. Some behaviors deal with substantive, academic content. Others deal with classroom procedure. For each of the seven behaviors, a description and an example are given in Table 1.

Table 1

Definitions and Examples of Interactive Teaching Behaviors

General Function	Specific Behavior	Description	Example
		SUBSTANTIVE BEHAVIORS	
Presentation	Explanation-Need	The instructor explains academic content in response to a clear and immediate student need for help.	During a seatwork assignment on short vowels, the teacher notices that Sonia is having trouble, so she goes over the sounds with her.
	Explanation-Planned	The instructor explains academic content but not in response to a specific or immediate student need. This often takes the form of a lecture.	The class comes to a section in the reading workbook on compound words. The teacher introduces this concept and puts some examples on the board.
Monitoring	Academic Observation	The instructor looks at or listens to student academic responses, in order to see how the student is doing.	While Eric is doing seatwork, the teacher looks at his paper to make sure he understands what to do.
	Academic Question	The instructor asks the student for a written or oral answer in order to observe and assess academic performance.	During group discussion, the teacher asks Mary to give the meaning of a word from that day's reading lesson.
Feedback	Academic Feedback	The instructor tells the student whether his answer is right or wrong. Could involve giving the right answer. Does not involve explanation.	The teacher asks Johnny to read out loud to the class the answers to the arithmetic problems. In oral reading circle, Susan hears Jim reading out loud while she reads along silently.
		PROCEDURAL BEHAVIORS	
Presentation	Structure/ Direct	The instructor states the goals of instruction or gives directions about the procedures and activities the student should carry out.	At the beginning of the math lesson, the teacher says "Today we are going to work on 10's and 1's like we did yesterday. Turn to page 20."
Feedback	Task Engagement Feedback	The instructor acts to control inappropriate behavior or to praise appropriate behavior. The focus is on the student's actions rather than the correctness of his answers.	Billy is out of his seat and standing by the pencil sharpener. The teacher tells him to "hurry up and get back to work."

All instruction was coded as occurring in one of two general instructional settings -- self-paced or other-paced. In self-paced settings the student works independently and determines for himself the rate at which work gets done. The most frequent example of a self-paced setting is "seatwork." Seatwork may take place for a long period, with different students doing different tasks, while the teacher circulates around the room or provides help as needed. It is also possible during a group lesson for the teacher to let the students "finish the page on their own." The five minutes students spend working problems individually would also be coded as self-paced. In other-paced settings, the student must interact with other students or must share the teacher's attention with other students. The pace of instruction is determined by the whole interactive unit and is beyond the control of the individual student. The most frequent example of an other-paced setting is a group lesson, where the teacher instructs two or more students at the same time. A group of students working together without the teacher would also be coded other-paced.

Table 2 provides descriptive statistics on the percentage of the time that an individual student receives different interactive teaching behaviors in each of the two settings.[1]

Insert Table 2 Here

For instance, on the average, a student in grade two receives explanation based on need in a self-paced setting during 1.2 percent of his reading instruction. The sum of all behaviors with direct substantive academic

[1] More complete descriptive statistics, including class-level data, can be found in Filby and Fisher (1977).

Table 2

Frequency of Occurrence of Interactive Teaching Behaviors, by Setting

Teaching Behavior	Grade 2 Reading		Grade 2 Mathematics		Grade 5 Reading		Grade 5 Mathematics	
Self-Paced Settings (Seatwork)								
Explanation-Need	1.2	(1.1)	2.2	(2.2)	0.4	(0.6)	1.5	(2.2)
Explanation-Planned	0.1	(0.3)	0.2	(0.6)	0.0	(0.2)	0.0	(0.2)
Academic Observation+	0.2	(0.4)	0.3	(0.8)	0.1	(0.2)	0.0	(0.2)
Academic Question+	0.3	(0.5)	0.1	(0.3)	0.1	(0.2)	0.1	(0.5)
Academic Feedback	3.4	(2.5)	2.4	(2.3)	1.2	(1.4)	1.1	(1.3)
Total Substantive*	5.2	(3.3)	5.2	(4.1)	1.9	(1.7)	2.7	(2.8)
Structure/Direct	0.4	(0.5)	0.4	(0.7)	0.1	(0.3)	0.1	(0.4)
Task Engagement Feedback	0.9	(1.2)	1.0	(1.6)	0.4	(0.8)	0.5	(0.8)
Total Interaction	6.5		6.6		2.3		3.3	
No Teaching Behavior	57.8		66.9		66.4		72.7	
Total	64.3		73.5		68.7		76.0	
Other-Paced Settings (Group, Interactive)								
Explanation-Need	0.3	(0.4)	0.9	(1.5)	0.3	(0.4)	1.1	(1.6)
Explanation-Planned	1.9	(1.5)	3.3	(3.1)	2.1	(2.1)	4.5	(3.9)
Academic Observation+	0.2	(0.4)	0.1	(0.3)	0.1	(0.2)	0.0	(0.0)
Academic Question+	6.0	(3.2)	5.1	(4.8)	5.0	(3.2)	3.3	(3.9)
Academic Feedback	13.0	(6.3)	4.9	(4.1)	12.1	(5.8)	6.1	(5.8)
Total Substantive*	21.3	(8.2)	14.4	(9.7)	19.6	(7.6)	14.9	(10.6)
Structure/Direct	4.5	(2.6)	3.6	(3.2)	3.5	(2.2)	2.5	(2.3)
Task Engagement Feedback	0.8	(1.5)	0.6	(1.0)	0.5	(0.7)	0.6	(1.0)
Total Interaction	26.7		18.6		23.6		18.0	
No Teaching Behavior	9.0		7.9		7.6		6.0	
Total	35.7		26.5		31.2		24.0	

Entries are: Mean (Standard Deviation)

All variables are expressed as percentages of student instructional time in reading or mathematics.

Sample size is 139 students in grade 2 and 122 students in grade 5.
Data came from the B-C period (January to May), with approximately 15 full days of observation per class.

+ Partly because academic observation was so infrequent, academic observation and academic question were combined for analysis. The combined variables was labelled "academic monitoring."

* Total Substantive includes Explanation-Need, Explanation-Planned, Academic Observation, Academic Question, and Academic Feedback.

content is shown in the rows labeled "Total Substantive." On the average, a student in grade two receives substantive instruction in a self-paced setting during 5.2 percent of his reading time.

To put these percentages in perspective overall statistics on percentage of time in each setting are also given. Students in both grades and both subject matter areas spend, on the average, at least 60 percent of their time in seatwork. There is more seatwork in grade 5 than in grade 2. There is more seatwork in mathematics than in reading. (This same pattern was reported in Phase II of BTES. See McDonald and Elias (1975).)

The amount of instruction received by a student during seatwork is very small, especially in grade five. Over half the time during reading and mathematics, students work on their own, with no instructional interaction.

Other-paced settings are, by definition, primarily interactive. Other-paced settings generally occur for less than one-third of the student's instructional time. During most, but not all, of this time some instructional interaction is occurring. Time with no immediate teaching behavior in a group setting would include things like having students put their names on their papers, having students briefly read some material or work a problem, or talking about non-academic content during the reading or math lesson.

There are some interesting patterns in the frequency of occurrence of different teaching behaviors in different settings and for different subject matter areas. Explanation occurs more often in mathematics than in reading. Apparently the content of mathematics lends itself more readily to the explanation of concepts and skills. Notice that explanation specifically based on immediate student need occurs more often in self-

paced settings than in other-paced settings. One advantage to seatwork is that it allows the teacher to respond to individual students on a tutorial basis and to tailor the presentation to the student's needs.

In general, the most frequent behavior is academic feedback. This is true in both settings, grades, and subject matter areas. Academic feedback is more frequent in reading than in mathematics. In part, this is the reverse side of the trend toward more explanation in mathematics than in reading. It is also the case, however, that academic feedback includes a variety of different specific behaviors, some of which are unique to reading. In particular, oral reading involves high levels of feedback. When one student reads aloud while the target student reads silently, the target student receives feedback from the student who is reading aloud; he hears the correct word as he attempts to read the word himself. (If the oral reader makes a mistake, then the teacher often intervenes with feedback.) Feedback during practice reading accounts for about half of the total academic feedback received in grade two reading and about one-third of the academic feedback received in grade five reading.

Correlations with Engagement

Table 3 shows the correlation between each of the interactive teaching behaviors and student engagement.[1]

Insert Table 3 Here

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[1] A more detailed analysis and discussion of these relationships, including multiple regression analyses and scatter plots, can be found in Filby and Cahen (1977, 1978). These analyses will also be elaborated in the final report of Phase III-B of BTES (Fisher, et al., in preparation, scheduled for completion in June, 1978).

Table 3

Correlations of Interactive Teaching Behaviors with % Engaged

General Function	Specific Behavior	Quadrant 2R	2M	5R	5M
Presentation	Explanation-Need	04 *08*[1]	-02 *-03*	09 *-13*	-15 *-10*
	Explanation-Planned	24 *14*	27 *01*	09 *02*	45 *35*
	Structure, Direct	-03 *-13*	20 *15*	-01 *-04*	29 *32*
Monitoring	Academic Monitoring	37 *22*	40 *23*	19 *26*	31 *19*
Feedback	Academic Feedback	39 *45*	29 *11*	42 *14*	39 *28*
	Task Engagement Feedback	-22 *-14*	-25 *-22*	-43 *-23*	-30 *-06*
Total Substantive Interaction[2]		48	42	43	46

[1] The numbers in gothic type are the correlations obtained in the B-C period (January to May), with approximately 15 full days of observation per class. The numbers in *italic* type are corresponding correlations from the A-B period (October to December), with approximately 5 days of observation per class.

[2] Total Substantive is the sum of four behaviors -- Explanation-Need, Explanation-Planned, Academic Monitoring, and Academic Feedback.

Sample size is 139 students in grade 2 and 122 students in grade 5. Correlations reach significance at the .05 level when $r \geq 18$.

In order to examine general effects, the percentage of time for each behavior was summed across the two instructional settings.

Two sets of correlations are given in each of the four quadrants. The first set is correlations based on data from the B-C period (January to May), with approximately 15 full days of observation per class. The second set (in italic type) is correlations based on data from the A-B period (October to December) with about 5 days of observation per class. The data set from the B-C period is larger and variables are more reliably measured, therefore B-C correlations should be regarded as the primary analysis. Correlations from the A-B period provide a form of replication.

The results for individual variables, shown in Table 3, will be discussed by function, beginning with monitoring.

Academic monitoring is represented by one variable, a combination of the observation categories of academic observation and academic question. Primarily, this variable indicates the frequency with which the teacher asks questions of students. Frequency of monitoring is positively correlated with engagement in all four quadrants. The more often a student is asked a question, the higher his engagement rate. This result was particularly consistent across both quadrants and time periods.

Feedback is represented by two variables with very different patterns of association. Academic feedback is information to the student about the correctness of his academic responses. In the A-B period, academic feedback had an especially high positive correlation with engagement in grade two reading. In the B-C data set, the effect is more general. In all four quadrants, academic feedback has a significant, positive correlation with engagement. Students who receive more academic feedback have higher rates of engagement. This effect is particularly strong in reading.

Task engagement feedback is consistently negatively correlated with engagement. Task engagement feedback gives the student information about the appropriateness of his behavior. Theoretically, it includes both positive feedback ("I like the way you're working") and negative feedback ("Pay attention or you'll miss recess"). An examination of the A-B results suggested that task engagement feedback is primarily negative and that it is elicited by lack of student engagement. When students are working smoothly, engagement is high and relatively little engagement feedback is given (not much praise). When students are not working smoothly and off-task behavior occurs, the teacher responds to control the inappropriate behavior. Support for this hypothesis was found in a breakdown of the B-C data. Two combination variables were created: task engagement feedback in connection with student on-task behavior ("positive feedback") and task engagement feedback in connection with off-task behavior ("negative feedback"). Positive feedback was extremely rare. On the average, in each quadrant, it occurred less than half of one percent of the student's instructional time. It accounted for only about 20% of the total task engagement feedback in grade two and only 10% of the total in grade five. Task engagement feedback is primarily negative. It represents a response to off-task behavior and indicates a general lack of control.

The presentation variables appear to be more strongly related to engagement in mathematics than in reading. Structure/direct involves presentation of procedure, either a description of the content to be covered or specific directions on what to do. Structure/direct has a generally positive relationship with engagement in mathematics. This category accounts uniquely for only 1% or 2% of the variance in engagement,

but the pattern is consistent across both grades and time periods. It appears that, in mathematics, students who receive more structuring and direction from the teacher have higher rates of engagement.

Explanation-planned also has significant positive correlations with engagement in mathematics. The reader may recall from Table 2 that explanation, unlike other variables, occurs relatively more frequently in mathematics than in reading. Planned explanation of concepts and procedures seems to be called for more often in mathematics than in reading, and its occurrence is positively associated with engagement.

These results for the three interactive teaching functions and the individual behaviors can be summarized in a single parsimonious explanation of the data -- more substantive academic interaction between teachers and students is associated with higher student engagement. As a type of statistical summary, we computed the correlation between total substantive interaction and percent engaged. This correlation, for each quadrant, is shown at the bottom of Table 3. Total substantive interaction is the sum of four behaviors -- explanation-need, explanation-planned, academic monitoring and academic feedback. This particular combination was used because it was developed in the theoretical grouping of variables. Note both the size of the correlation and the consistnecy across quadrants. The strongest effect is at the general level -- more interaction is associated with more engagement.

Teaching Behavior, Setting, and Engagement

From the descriptive statistics in Table 2, we know that most instructional interaction takes place in a group setting. From the correlations in Table 3, we know that the amount of instructional interaction is positively associated with student engagement rate. One way of integrating these two facts is to state that setting is related to engagement rate. Engagement rates are higher in a group setting then during independent seatwork. The more time a student spends in seatwork, the lower his overall engagement rate is likely to be. One estimation of the magnitude of this effect is shown in Table 4.

Insert Table 4 Here

The average engagement rate in self-paced settings like seatwork is at least 13% lower than the average engagement rate in other-paced groupwork. If some students spend a much higher proportion of time in seatwork than others, a lower engagement rate is likely to result. Looking at the columns on minimum and maximum proportion of time in each setting, it appears that there are dramatic differences in use of different settings. In grade two reading, one student may spend 91% of his time in seatwork while another student spends only 43% on his time in seatwork. This difference in setting allocation translates into a 7% difference in overall engagement rate, based on the

Table 4

Variability in Use of Instructional Settings
and Average Engagement Rate, by Setting

Grade	Subject	Setting	% of Time Spent in Setting			Average Engagement Rate
			Average	Minimum	Maximum	
2	Reading	Self-Paced	64%	43%	91%	68%
		Other-Paced	36%	9%	57%	84%
2	Mathematics	Self-Paced	73%	22%	96%	67%
		Other Paced	27%	4%	78%	82%
5	Reading	Self-Paced	69%	37%	92%	70%
		Other Paced	31%	8%	63%	84%
5	Mathematics	Self-Paced	76%	37%	100%	72%
		Other-Paced	24%	0%	63%	85%

Sample size is 139 students in grade 2 and 122 students in grade 5.

Data came from the B-C period (January to May) with approximately 15 full days of observation per class.

average engagement rates in Table 4.[1]

This setting effect makes practical sense. Students are more likely to goof-off when they are on their own, with only general supervision by the teacher, than they are when they are in a group with direct teacher attention.

The setting effect is only part, however, of a more general positive effect of academic interaction between instructor and student. The average correlation between total substantive interaction and engagement, as shown in Table 3, is about .45. The average correlation between percentage of time in seatwork and engagement is only about .31. "Total substantive interaction" is a better description of the desired condition that is "groupwork."

There are three reasons why instructional interaction shows a positive effect over and above setting. Two have to do with the fact that time in a group setting includes time when no instructional interaction is taking place and during this time engagement is very low. As shown in Table 2, about one-quarter of the time during groupwork there is no immediate instructional behavior. But this percentage varies from one class to another. While substantive instructional interaction is taking place during groupwork, the level of engagement is very high. The range is from 95% engaged

[1]Actually, this difference is underestimated, because the average engagement rates in Table 4 do not take into account an additional effect of setting on engagement. Engagement is, on the average, lower in seatwork than in groupwork. Moreover, the higher the percentage of time in seatwork, the lower the engagement rate in seatwork! That is, the class with 43% seatwork is really likely to have an engagement rate of 72% in seatwork. The class with 91% seatwork is really likely to have an engagement rate of 60% in seatwork. This makes the overall difference in engagement rate more like 16% for these two extremes.

during substantive instructional behavior in grade five reading to 98% engaged during substantive instructional behavior in the other three quadrants. While no instructional behavior is taking place in groupwork, the engagement rate drops to around 50%. (The range is from 48% to 53% across quadrants.) What happens during this time? For one thing, the teacher waits while the students put their names on their papers. Even while the student was writing his name he would be coded "not engaged." This would be labeled an "interim" task, and the student would be coded "not engaged-interim." Althought he maybe doing what he is supposed to do, the student is not learning math or reading while he writes his name. Another type of not-engaged activity during groupwork is waiting. Some students wait while other students finish writing their names or finish working a problem. This reflects one of the disadvantages of other-paced settings--the student cannot go ahead at his own rate. In summary, engagement is high in group settings while instructional behavior is occurring and low in group settings when no immediate instructional behavior is occurring.

Naturally, the overall engagement rate in group settings is highly influenced by the amount of time when no instructional behavior is occurring. The percentage of other-paced setting time with no instructional behavior ranges from 0% to over 70%. The impact of this difference is reflected in the correlations in Table 5.

Insert Table 5 Here

In all four quadrants there is a high correlation between the percent of other-paced time when instructional behavior is occurring and the engagement

Table 5

Correlations Between Instuctional Behavior and Engagement Within and Across Settings

Interaction Variable	Engagement Variable	Quadrant 2R	2M	5R	5M
Percent of Other-Paced Time During Which Substantive Interaction Takes Place	Engagement in Other-Paced Settings	.54	.46	.56	.47
Percent of Other-Paced Time During Which Substantive Interaction Takes Place	Engagement in Self-Paced Settings	.31	.03	.46	.11
Percent of Self-Paced Time During Which Substantive Interaction Takes Place	Engagement in Self-Paced Settings	.18	.15	.18	-.14

Sample size is 139 students in grade 2 and 122 students in grade 5. A correlation $\geq$ .18 is significant at the .05 level.

Correlations are based on data from the B-C period.

Substantive interaction is the sum of explanation-planned, explanation-need, academic monitoring, and academic feedback.

rate in other-paced settings.

Notice also in row two of Table 5 that there is a degree of transfer in the impact of instructional behavior in other-paced settings. The percentage of other-paced time with instructional behavior is related to engagement rates in seatwork. One interpretation is that a pacing effect is involved. If during group lessons most of the time is directly involved with substantive instruction this may contribute to a sense of purposefulness may be associated with a sense of slow pacing and lack of real emphasis on academic learning. This general atmosphere may encourage off-task behavior during seatwork.

This effect of pacing on engagement in both other-paced and self-paced settings appears to be related to a finding reported by Ogden, Brophy, and Evertson (1977) in their study of organization and management techniques in first grade reading groups. They found that reading achievement was strongly related to the time lapse between teacher and children reaching the reading group and the actual beginning of the lesson. They concluded that "Once the last person (teacher or child) arrives in a reading group, the teacher should begin the lesson immediately. Any materials necessary for the lesson should be pre-arranged so that reading group time is not wasted on organizational tasks" (Ogden, Brophy, and Evertson, 1977, page 14). Pacing appears to relate to achievement, with student engagement rate as a mediating factor.

There is one final way in which teacher-student interaction influences engagement beyond the role of group settings. During seatwork, engagement rates are generally lower than in group settings, but engagement rates are higher during seatwork when students get more contact with the teacher.

During seatwork some teachers move around the room giving feedback and explanation; other teachers are busy doing other things. With a number of children to be covered, any one child cannot received a lot of teacher attention; but in the classes we observed some students received substantive instruction during as much as one-fourth of the time they were doing seatwork while other students never received individual attention during seatwork.

The correlations in Table 5 indicate that in three of the four quadrants the amount of substantive instruction a child received during seatwork was positively associated with student engagement in seatwork. This effect is even greater when one looks at only those classes with a high percentage of time in seatwork. As a group, these classes tend to have lower engagement rates and somewhat higher percentages of substantive instruction during seatwork. Within this group, the amount of substantive instruction in seatwork tends to be positively related to engagement. In grade two math, classes with over 70% seatwork were divided into two groups. One group had substantive interaction during a relatively large percent of seatwork time (an average of 11%); the other group had substantive instruction during only about 5% of seatwork time. The engagement rate during seatwork in the high interaction classes averaged 71%. The engagement rate during seatwork in the low interaction classes averaged 61%. In other words, if for some reason a large percentage of instructional time is spent in seatwork, it is important to monitor the students and provide academic feedback and explanation as often as possible.

Discussion

The results of this study indicate that student engagement rates

are higher when students spend more time in substantive instructional interaction. This means that if the goal is to increase the percentage of the time that students are actively engaged in learning, the following procedures should be useful:

1. Part of the instructional time should be spent in a group lesson. (Engagement rates are higher in group settings. As the percentage of time in seatwork increases, the engagement rate during seatwork decreases.)

2. During group lessons, as much of the time as possible should be spent actually working on substantive content. The amount of time spent in organizational activities or waiting for other students should be minimized. (This brisk pacing with a focus on academic content is associated with higher engagement rates in group settings and during seatwork.)

3. During seatwork, especially when a large percentage of time is spent in seatwork, the teacher should monitor student activities and provide academic feedback and/or explanation. (Engagement rates are higher in seatwork when students have more contact with an instructor.)

4. Two particularly useful instructional behaviors are academic monitoring and academic feedback. Student engagement rates are higher when students are asked more questions and given more feedback about whether their answers are right or wrong.

5. Especially in mathematics, student engagement rates are higher when students receive more structuring of the task, more direction on what to do and more explanation of concepts and skills.

6. Telling students to get back to work when they are off-task (task engagement feedback) is not an effective approach to classroom discipline. Task engagement feedback is used more often with students who are off-task more often. Presumably, more positive procedures increase engagement rates and reduce the need for task engagement feedback.

In general, these results are consistent with the view of instruction expressed by Berliner and Rosenshine (1977). In a review of research, they concluded that knowledge acquisition in the classroom is accomplished more successfully when teachers use "direct instruction." High student engagement could itself be considered a component of direct instruction.

The results reported here indicate that high student engagement is associated with other elements of direct instruction such as monitoring of student activities, direct questions and academic feedback, and, most generally, a clear and consistent focus on academic activities.

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Changing Academic Learning Time: Clinical Interventions in Four Classrooms

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Changing Academic Learning Time: Clinical Interventions in Four Classrooms

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Simultaneous with the relatively large scale investigation of classroom teaching and learning that constituted the major research effort of the Beginning Teacher Evaluation Study (BTES), a much smaller study was also conducted. The smaller research effort was not designed to describe teacher behavior or to correlate instructional variables. This small study was designed to change teacher behavior. The changes in teaching that were our goal were those that 1) promoted efficiency in management of the classrooms; 2) increased teacher sensitivity to the difficulty level of the materials students worked with; and, 3) increased the engaged time of students in academic pursuits. Academic learning time (ALT), defined as a student's engaged time in academic subject matter of intermediate level difficulty for that student, was the major dependent variable for this study. The model of instruction that we worked with posited ALT as the linking variable through which teacher behavior affects student achievement.

Interventions in the functioning of four second-grade classrooms were undertaken to understand more about teaching and ALT. These interventions, were clinical studies of classrooms (see Fisher and Berliner, 1977), much

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more than they were experimental studies of behavior. These clinical studies were conducted in the spirit of the old recommendation to social scientists that "If you really want to understand something, you should try to change it." We were trying to understand the relations among teaching, ALT and student achievement. Thus we intervened in classes, trying to change teaching behavior and ALT, in order to better understand our instructional model.

Design of the Study

The data for each class may be considered as conforming to a time series design of the type

$$O_1 \quad O_2 \quad O_3 \quad I_1 \quad O_4 \quad I_2 \quad O_5 \ldots I_n \quad O_n$$

where O represents the observation of one or more dependent variables, and I represents the introduction of an intervention (cf. Glass, Willson, & Gottman, 1975; Kratochwill & Levin, 1977). This design is called the single-N-multiple-I design. The design that was used may also be classified as the "AB" behavior modification design, where A refers to baseline data and B to the data collected after intervention has been started. The design in this study made use of an intact group (six target students in each of the four classes) and is unit-repetitive, where the same group is measured at successive points in time. The data from each class, for each variable, was collected as part of the ongoing data collection activities that made up the major research effort of BTES. Once per week, between October and May, a trained observer was present for the entire school day recording information about teacher and student behavior.

Each of the four classrooms were the subject of individual study and

individually tailored interventions. Yet, at some superordinate level, each of the interventions had the same goal and were each designed to change the same behaviors of students. At this superordinate level the time series design, looking across classes, is best labeled a multiple-N-multiple-I design of the type:

Teacher 4 O_1 O_2 O_3 I_1 O_4 I_2 O_5..I_n O_n

Teacher 5 O_1 O_2 O_3 I_1 O_4 I_2 O_5..I_n O_n

Teacher 9 O_1 O_2 O_3 I_1 O_4 I_2 O_5..I_n O_n

Teacher 15 O_1 O_2 O_3 I_1 O_4 I_2 O_5 I_n O_n

Graphic displays of the time-series data for at least ten dependent variables (described below) are available with each of the case studies in the four classrooms.

In addition to the four intervention classes where intensive clinical work was to be undertaken and documented, another group of classes were to be working toward implementing the BTES model of instruction. This group, consisting of seven teachers, were designated the workshop classes. The teachers of these classes participated in two half-day workshops on the importance of engaged time and related variables. This treatment group was included in the design to answer questions about whether or not teachers could be given brief and inexpensive workshops presenting the BTES instructional model, and subsequently implement aspects of that model in their own classes.

A third group of second-grade classes (N=14), comprised of the

remaining second-grade sample, were designated control classes. No treatment was designed for these classes. Data were collected from each class, each week, as part of the ongoing BTES data collection activities.

This study, then, when concentrating just on the interventions, may be described as a four classroom time-series design, as noted above. The study may also be described as a three-group comparative study whereby the intervention classes (maximum treatment) and the workshop classes (minimum treatment) are compared with each other and with the control classes (no treatment). In comparative analyses records of the values for particular variables before the intervention began can be compared to records of the values of those variables after the intervention began, in all three groups of classes. Data reflecting both time series and comparative designs will be presented in this paper.

Selection of Classes for the Three Groups

In November of the academic year in which the large field study was being conducted, two consecutive weeks of observational data were analyzed for all 25 second-grade classrooms involved in the BTES study. The data from each classroom, for each individual student, provided estimates of the difficulty level of the material, the total engaged time, the total non-engaged time, the total reading and mathematics time (the combination of engaged and non-engaged time), and the percent of time the student was engaged.

The following factors were used in the first round of selection for the intervention classes:

1. Low or inconsistent engaged time.

2. Extremes of easy or hard difficulty level.

3. Inconsistencies in difficulty level from week to week.

4. Comments from field workers recorded on an open-ended, anecdotal questionnaire. The questionnaire asked for a brief description of classroom structure, teacher behavior, teacher attitude toward the study and teacher interaction with target students.

Using these factors twelve perspective classrooms were chosen as possibilities for the clinical intervention. A third week of observational data were analyzed for this pool of twelve classes to further check on the validity of the choices made. In addition, during the last two weeks of November, all of the twelve classrooms were observed by at least two BTES staff members. Of the twelve, eight classrooms were described by two or more staff members as feasible candidates for intervention (i.e., classrooms in which ALT might be increased with simple intervention strategies; and the cooperation and interest of the teacher could be obtained).

The eight teachers were asked whether they would be interested in additional involvement in the BTES study. The teachers were told that they would serve as part of a team that would focus on developing methods for increasing ALT for students in their classes.

Five of the eight teachers agreed to participate in the study. These teachers volunteered with the full realization that participation entailed extra observers in their classroom on a regular basis, and with knowledge that there would also be many additional conferences. Four classrooms were chosen from these five for intervention. All remaining second-grade teachers were invited to be part of the workshop group.

Seven teachers agreed to participate in this attempt to change behavior through discussion and exhortation. The other 14 second-grade teachers unknowingly became members of the control group. The intervention group teachers and the workshop group teachers each received small honoraria for their extra efforts in the study.

Variables of Interest

In this attempt to change teacher behavior and classroom characteristics ten variables were of particular interest. These were:

1. Wait time in minutes. Based on previous experience we believed that in classes where wait time was high, ALT and achievement would be low. Wait time occurs when many students are not able to start activities because they have not yet been assigned something to do, or when many students have nothing to do because they finished an assignment early. Wait time appeared to be a variable that could be manipulated through intervention.

2. Transition time in minutes. Based on previous experience we believed that in classes where transition time was high, ALT and achievement would be low. Transition time is accrued while students are moving from one location or resource center to another, or are switching from one activity to another. Transition time appeared to be manipuable through intervention.

3. Total allocated reading time, in minutes.

4. Total allocated mathematics time, in minutes.

5. Percent of time students are engaged in reading.

6. Percent of time students are engaged in mathematics.

7. Percent of time students are in reading materials or activities of intermediate level difficulty.

8. Percent of time students are in mathematics materials or activities of intermediate level difficulty.

9. Academic learning time in reading.

10. Academic learning time in mathematics.

Variables 3, 5, and 7 are needed to compute ALT in reading, which is variable 9. Variables 4, 6, and 8 are needed to compute ALT in mathematics, which is variable 10. Note that ALT in reading or mathematics (variables 9 and 10) can be increased by increasing the length of time allocated for instruction (variables 3 and 4), and/or by increasing the percent of time students are engaged with their academic subjects (variables 5 and 6), and/or by increasing the percent of time students are working with materials of intermediate level difficulty (variables 7 and 8). Decreases in variables 1 and 2 may lead to increased ALT by making possible more time to allocate to academic instruction. All ten variables, then, are important and interrelated dependent variables in this study. But it must also be noted that each of the intervention classes and each of the workshop classes was unique. Individual and quite different diagnoses, followed by specifically tailored prescriptions for teaching or managing classes occurred in each of these classes. The only constant concern was that the treatment logically affect ALT in reading and ALT in mathematics. Because of this one common goal, perhaps only the ALT measures are to be regarded as the indicators of treatment effect.

Method

A team of two males and two females were in charge of the intervention. Three of the team members held doctorates in educational psychology, had experience in classrooms as researchers, but had never taught elementary school. The fourth team member was a certificated teacher with many years experience as a regular and special education elementary school teacher. One or more members of the intervention team visited each of the four classes one or more times per week, for about 15 weeks between January and May. Each member of the intervention team had major responsibility for a particular class, and only ocassionally visited other classes. Extensive notes were kept each time a member of the intervention team observed class or held a conference with the classroom teacher. These records ultimately formed the descriptive base for the case study of intervention in each class.

What was observed differed dramatically by class. Therefore the recommendations to change teacher behavior or classroom practices varied. Nevertheless, all four interventions used the same model of instruction as a guide. That model contends that there are five teaching functions that impact on ALT and that ALT is the strongest predictor of achievement in an academic content area (see Berliner, Cahen, Filby, Fisher, Marliave, and Moore, 1976). The five teaching functions are diagnosis and prescription (preactive or presage variables), and explanation, feedback and monitoring (interactive or process variables). The observations and conferences were held during each week of the intervention and were directed toward the teacher behaviors necessary to carry out these functions in order

to increase ALT. For example, the field notes of events during the second week of observation in the class of Mrs. M reveal:

> "It was agreed upon that one of the students, Bambi, would be observed intensively. It was clear, even from casual observation, that the child was not staying on tasks very long. Another child, Jennifer, was also to be observed more systematically because her on-task behavior also seemed to be quite low. Mrs. M was to take responsibllity for observing still a third child, who seemed not to be turned on to any aspect of learning. A good deal of the conference time was spent trying to build rapport with Mrs. M such that later on in the intervention there would be more likelihood of implementation of suggestions. All sorts of little items to be worked on later in the year came up during the first week's observation. For example, because of previous abuses, the teacher refused to let any children sharpen their own pencils. Thus when a child did have a legitimate need to sharpen a pencil the teacher had to do it for the child. These kinds of events were noted, and were to be worked on later during the year. In addition, the teacher's language used to describe children's activities was to be worked on. The teacher described some children who are off-task as lazy. Another child was called backward. These are descriptive terms which can do nothing for remediation. It was decided that the way the teacher described certain activities in the classroom would have to be worked on, so that a language which allows for diagnosis and prescription could be put into use."

This excerpt reveals that in this class on-task time is to be an important concern in the intervention. Some aspects of the management system that was in use were also perceived as problems, potentially affecting ALT. And the teacher's linguistic behavior was going to come under scrutiny because the language used by the teacher precluded accurate diagnosis and prescription, which are two of the five teaching functions that are hypothesized to affect ALT.

In the team-taught class of Ms. K and Ms. S, the fifth week diary describes an interesting event.

> "There was a discussion of the seating pattern used by Ms. K and Ms. S, wherein faster and slower students were seated together in clusters of 4 or 5. I suggested that homogeneous clusters

> might be used so that the teachers could provide feedback and explanation to several students seated together and working on the same kinds of problems. Ms. S explained that the heterogeneous seating served two purposes. First, it allowed faster students to tutor their slower peers. Second, it prevented social stratification according to academic achievement. She did concede, however, that the highly individualized curriculum made it difficult for students to tutor each other, so that the tutoring was not common. Ms. S agreed to consider grouping 2 or 3 students at one level with 2 or 3 students at another level. This was seen as an intermediate seating strategy that would allow the teachers to provide feedback and explanation to 2 or 3 students at once."

From the above excerpt you can see how the intervention team's suggestions were modified by the teacher's beliefs, resulting in a compromise that was the best that could be obtained. The interplay of suggestion, resulting in counter-suggestion, leading to action or inaction, characterized many of the conferences held throughout the intervention.

The intervention followed no set pattern. Consultants were brought in for one teacher. Television was used for feedback in three classrooms. Curriculum materials were purchased for one teacher, a clock was installed for another. Whatever seemed appropriate was suggested. Whatever teachers were willing to try was tried, observed, and informally evaluated. The goal of the intervention was always to increase ALT. The entire class rather than just the six target students was the focus of the intervention. The target students, however, continued to be the major source of data about any changes that might have occurred in these classes.

In the workshop classes teachers had to implement the model of instruction without any outside help. This treatment was designed to require a minimum time commitment by personnel and to be very inexpensive.

In the middle of January, and again six weeks later, teachers met for a half-day workshop on the BTES model of instruction. As a result of the first meeting teachers publically announced the special projects they had chosen to increase ALT in their classes. One teacher intended to increase feedback; another teacher was going to decrease transition time; two teachers intended to reduce wait time in their classes; etc. Each of the seven teachers was sent a follow-up letter reviewing the BTES instructional model and restating their commitment to changing some aspects of classroom management and their own teaching behavior. The second workshop meeting focused on the teachers' perceived success and failure in changing their behavior. At the conclusion of the second half-day meeting the workshop teachers were once again exhorted to work on ways to increase ALT. There was no special follow-up to see if these teachers implemented any of the suggestions that were made at the two workshops. Regular data collection continued in these classes as part of the ongoing field study that constituted the larger research program of the BTES.

Data Analysis

Both time series data, for the intervention classes, and data on mean changes by treatment group will be presented.

Time series: Single-N-Multiple-I Design. The values of the 10 variables of interest were graphed in each of the four intervention classes. The most interesting aspect of the data looked at in this way was the enormous day-to-day variability for each variable in each of the classes. Two examples will suffice. Transition time and total time

allocated for mathematics, for one teacher, are given in Figures 1 and 2. The obvious variance in time from one observation day to the next makes it very hard to discuss trends in these data, or to use mean values as appropriate descriptive statistics for these classes.

Insert Figures 1 and 2 about here

Figures 3-10 present the data on ALT in reading and mathematics on these four intervention classes. These data reflect the major dependent variable in the study. The series of data points presented in Figure 3, describing ALT in reading in Class 4, appears to decline over the course of the intervention. This was not intended. In every other graph of ALT in reading and in mathematics there appears to be a slight trend toward increased ALT over the course of the intervention. These were intended outcomes of the study.

Insert Figures 3-10 about here

Time Series: Multiple-N-Multiple-I Design. As noted above the four intervention classes may be considered replicates of the same time series design. In that view, the combined data on each of the 10 variables of interest becomes worth exploring.

For wait time the pre to post intervention mean change was from an average of 5.29 minutes to an average of 6.43 minutes per day for the four classes combined. This is a shift of +1.14 minutes per day, in a direction counter to the goals of the intervention.

For the variable of transition time in these classes the pre to post intervention mean change, over the four classes, was from an

average of 34.38 minutes per day to an average of 36.41 minutes per day. This increase in mean transition time of +2.03 minutes per day was not an intended goal of the intervention.

For the variable of total allocated time in reading we find, over the four classes, a pre intervention mean of 73.68 and a post intervention mean of 81.48. This represents an average increase in total allocated reading time, over the four classes, of 7.80 minutes per day. This was an intended outcome of the intervention study. The allocated time for mathematics for the four classes shows a pre intervention mean of 37.16 minutes per day and a post intervention mean of 40.47 minutes per day. This is an increase in allocated time for mathematics of 3.31 minutes per day, an intended outcome of the study.

It was originally thought that increases in allocated time would occur because of decreased time spent in transitions and in wait time. This was not so. Thus the increases in allocated time that we noted, averaging about 10 percent in both reading and mathematics, can only have occurred by a reduction of time ordinarily devoted to other classroom activities.

Engaged time in reading showed a change from 63 percent to 66 percent in the four classes over the course of the study. The mathematics data for this same variable showed a change from a pre intervention mean of 63 percent to a post intervention mean of 65 percent in the four classes. Both of these small increases in engaged time were intended outcomes of the intervention.

Over the four classes the percent of time students worked with intermediate level activities also changed. In reading the mean shifted

from 53 percent to 50 percent. This decrease over the course of the study was not intended. In mathematics the mean shifted from 41 percent to 46 percent. This increase in the percent of time students worked with intermediate difficulty level materials in mathematics was an intended outcome of the study.

In all four classes the goal was to change ALT. The variables, strategies, and the activities of the intervention described above were part of the overall plan to increase ALT in reading and mathematics. The group mean for ALT in reading was 21.32 minutes per day before the intervention. At the end of the study the mean ALT per day in reading was 25.49 minutes per day. This increase of 4.17 minutes per day was intended and was gratifying to note. In mathematics the pre intervention mean for ALT, over the four classes, was 8.96 minutes per day. This increased over the course of the intervention to 11.78 minutes per day. This increase of 2.82 minutes per day was intended and is also gratifying to note.

Mean change by treatment group. Another way to examine these data is to compare the 3 treatment groups as if a controlled experiment had taken place. Tables 1-12 present these data. In each table means for the pre intervention or base-line time period for each of the treatment group are given for each of the major variables of interest. These means are based on 4 or 5 observations completed in the October-December time period and are given in the column titled "A Time Period". About 15-17 observations were completed between January and April, while the intervention was occurring. These means are also presented for each treatment

group for each variable of interest. They are given in the column titled "B Time Period." In addition, each table provides a difference score, to be considered a crude indicator of treatment effect.* The predicted order of difference scores for each of these variables, by treatment group, was interaction classes>workshop classes>control classes; and intervention and workshop classes > control classes. The data support the latter prediction. The control classes show no evidence of change in the desired directions on these important variables. In general, the intervention classes and the workshop classes do show evidence of change. Interesting enough, the workshop classes, in general, exceeded the intervention classes in the magnitude of the change.

Insert Tables 1-12 about here

On the major variables of interest, ALT and engaged time in academic pursuits, we note substantial treatment effects. Table 9 presents data on ALT in reading. The two experimental groups show gains of about 6 minutes a day, while the control group shows virtually no change at all. These gains in the two experimental groups amount to increases in ALT of about 25 percent.

In mathematics, as shown in Table 10, the experimental groups increased in ALT while the control group decreased in ALT. In the intervention classes ALT increased about 20 percent, and in the workshop

*Means in these tables differ slightly from those computed for the intervention classes discussed above. These data were computed differently, and rounded off differently, resulting in the discrepency. The means in these tables, however, are not regarded to be as important as the direction of the shift from the pre intervention to the post intervention time period.

classes the increase in ALT was a dramatic 56 percent.

The concern with ALT as a major construct of interest in this study may be debateable. But the importance of engaged time as a necessary condition for academic learning in the classroom is much less controversial and is adequately supported in the literature. Tables 11 and 12 present these data in the form of engaged minutes per day in reading and in mathematics. In reading, engaged time increased about 17 percent in the intervention classes, about 7 percent in the workshop classes, and 0 percent in the control classes. (Note, however, that the control classes did start with much higher levels of engagement. Therefore, a plausable hypothesis is that the control classes, as oppossed to the intervention classes, were already at a ceiling on this variable.) In table 12 engaged time in mathematics is displayed. The intervention classes showed an increase in engaged minutes per day of about 12 percent. The workshop classes showed an increase in engaged minutes per day of about 22 percent. The control group, with no special treatment, showed a loss in engaged minutes per day of about 19 percent over the course of this study.

Conclusions and Suggested Classroom Practice

The number and complexity of the events that teachers have to deal with each day were intensively observed in four second grade classrooms. Attempts were made to view these events in terms of their effects on certain variables hypothesized to be important for instruction. Teachers were then asked to change their behavior and classroom practices in order to affect those variables. These attempts at modifying classroom teaching

were frustrating because changes in teacher behavior and classroom management systems take so long and meet with such resistance. Nevertheless, these clinical interventions did result in changes in the desired direction for most of the variables of interest. Moreover, the documentation of the interventions has lead to a series of first hand reports about how classrooms can be modified and how changes do or do not take place. (The full report of this intervention study, cited above, contains these narratives.)

The most impressive data in this study, because of its policy implications, comes from the workshop classes. In approximately 12 hours of meetings a theory of instruction was presented, public commitment to change was elicited, self reported evaluations were made, and time for mutual problem solving of instructional problems was made available. The results, if these data are accepted, indicate that the workshop classes decreased in transition time, increased in allocated time for reading and mathematics, increased in engaged time in reading and mathematics, increased in the percent of time students were in intermediate level difficulty material, and increased in ALT in reading and in mathematics. In comparison to the intervention classes, and particularly in comparison to the control classes, the workshop classes showed substantial and positively valued changes on the indicators chosen to represent the BTES model of classroom instruction.

From the discussions with the seven teachers in the workshop classes, and the clinical interventions in the four classrooms, came many suggestions for increasing academic engaged time in elementary school. These

suggestions were often derived from a metaphor describing the elementary school teacher as "an overworked and underpaid executive." Picture, if you will, a harried executive with the responsibility for supervising three or more work groups totalling 25-30 "employees". The teacher/executive schedules these 30 charges with such people as the speech pathologist, reading specialist, parent volunteer, paraprofessional aide, etc. The teacher/executive also schedules movies, tests, field trips, etc. Other managerial duties include collecting milk money; sending Red Cross information home and then recording and taking responsibility for money donated to this cause; sending home permission slips for field trips, noting their return, and checking that all students have permission slips on file before leaving the school; updating on at least a weekly basis the individualized program charts and records mandated in recent federal and state legislation (e.g., Title 1, Public Law 94-142, Early Childhood Education). Information about bake sales, parent teachers association meetings and special television or school sporting events must also reach the child's home by means of the young, often irresponsible, child. More managerial decisions are needed when allocating scarce materials. Five or ten readers, or workbooks, or kits of a certain kind must be distributed to those who will profit most from them. Five or six children at a time are scheduled for the cooking or art or media room. All in all, our observations lend validity to the notion of teachers as pressured executives. Thus it appears proper to provide management consultation to improve the efficiency of the executive function. By doing so, it is anticipated that there would be increased productivity, as measured by increased engaged time in academic pursuits.

One strategy directed toward these ends was the institution of "help" signs in classes. When children who are working independently at their seats have a problem it often requires considerable time for a teacher or aide to remediate the difficulty. By giving each child a sign that can be put up, simply saying "help," the child's wait-time can be cut down. Another method of reducing wait-time is to use a sign-up sheet or the chalkboard for students to sign-in when they need new contracts or special tutoring. This prevents students from lining up at the teacher's desk and waiting 15 or more minutes to be checked out of one contract and started on another. With both help signs and sign-up sheets we have learned to recommend that alternate assignments be provided every student. These alternate assignments, such as drill work in math, silent reading in particular books, phonics drill using special reading kits,etc., can be assigned to students and can be worked on independently while they wait for the attention they need. Time in academic pursuits is then increased.

Transition time, which is measured as students move from one activity or area to another acitivity or area, can be reduced when starting assignments are provided. These starting assignments could be the same as alternate assignments, or they could be written directions on a board or even a quick statement to provide structure about what to do after, say, a class comes in from lunch. We witnessed too many children who did not know what was expected of them, when starting up some new activity. Young children, more than older ones, seem to be in particular need of this kind of structuring or goal setting.

Engaged time in academic pursuits can be increased by concentrating on reducing lesson disjointedness. Disjointedness, akin to Kounin's (1970) concepts of smoothness and momentum, occurs when the speaker system in a classroom blares out something, or a messenger comes in from the principal, or a child demands individual attention, while a planned teaching activity is occurring. Such disruptions can be reduced by changing certain rules of classroom management and by use of contingency management procedures. Teaching teachers how to handle special students with contingency management procedures is another useful strategy. In many classes one or two students with special emotional, intellectual or physical needs to be met required inordinate amounts of teacher contact time. Use of behavioral management techniques and time-out areas changed those demands. Teachers could supervise and work with other children in the classroom such that a more even distribution of teacher time was noted.

Architectural considerations also can affect engaged time in a classroom. The placement of an art area next to a reading area does not help the attentiveness of young readers. The use of tables, where five or more squirming children are expected to work independently and productively in their workbooks, is simply not a reasonable demand for many young learners. Some children cannot work in such an environment. In such a classroom ecology the use of a few desks, so that some children can have sufficient personal space to work in, has shown its utility. For some students marked increases in engaged time were noted after being switched from tables to desks when independent work was required.

Other suggestions to increase engagement in academic pursuits include helping teachers to learn to manage transitions better, to provide more academic and behavioral monitoring of student behavior, and to regularly structure the activity so that students know what is expected of them. Teachers need to supervise aides more closely to insure that academic matters receive the attention they should. And teachers need to be taught to focus on the way they spend time. Time is an accounting system for any teacher philosophy of education. Ultimately, any philosophy must be translated into actions that have duration. Keeping track of how much time is spent in particular curriculum areas and activities, therefore, is an excellent way to insure that belief systems are implemented.

Most of our concerns in this study were with "improving" the way classrooms function in order to understand our model of instruction. Our definition of improvement, therefore, was intimately tied to ALT and engaged time in academic pursuits, our major constructs. Someone with a different philosophical base might define improvement as increased mobility. Or, one could think of improvement as increased cooperation among students. Or, one could think of improvement as increased creativity in many areas. We purposely took a limited view of improvement. We always focused on engaged time in academic areas. But the suggestions made to accomplish the changes we valued, could reflect very different philosophies about teaching and learning and still reach the same goal. For example, we recommended that a child use a "help" sign to request aid when having difficulty with the materials assigned for seat work.

This strategy helps to increase the overall efficiency of the classroom by insuring that a teacher or aide gets to the child who needs help as quickly as possible. But the method we suggest, perhaps, can be viewed as fostering dependency on the part of the child. In a different classroom, where the teacher might want to foster cooperative behavior and reinforce self-motivated seeking of help, students may be taught to seek a designated peer tutor in the class when having difficulty with their assignments. The two techniques for seeking help, raising a help sign or seeking a designated tutor, may each result in increased time on task for a particular student since the difficulties the child is having would be alleviated rapidly.

The method chosen to increase time on academic tasks can vary when trying to induce changes in classes. The variations in methods may be due to the philosophical concerns of the teachers, the management and organizational programs of the school, or the prediliction of the persons trying to induce the changes. Nothing we have learned in the BTES study, however, has dissuaded us from believing that the engagement in and the difficulty level of academic activities are crucial variables to manipulate when attempting to improve the academic achievement of elementary school students.

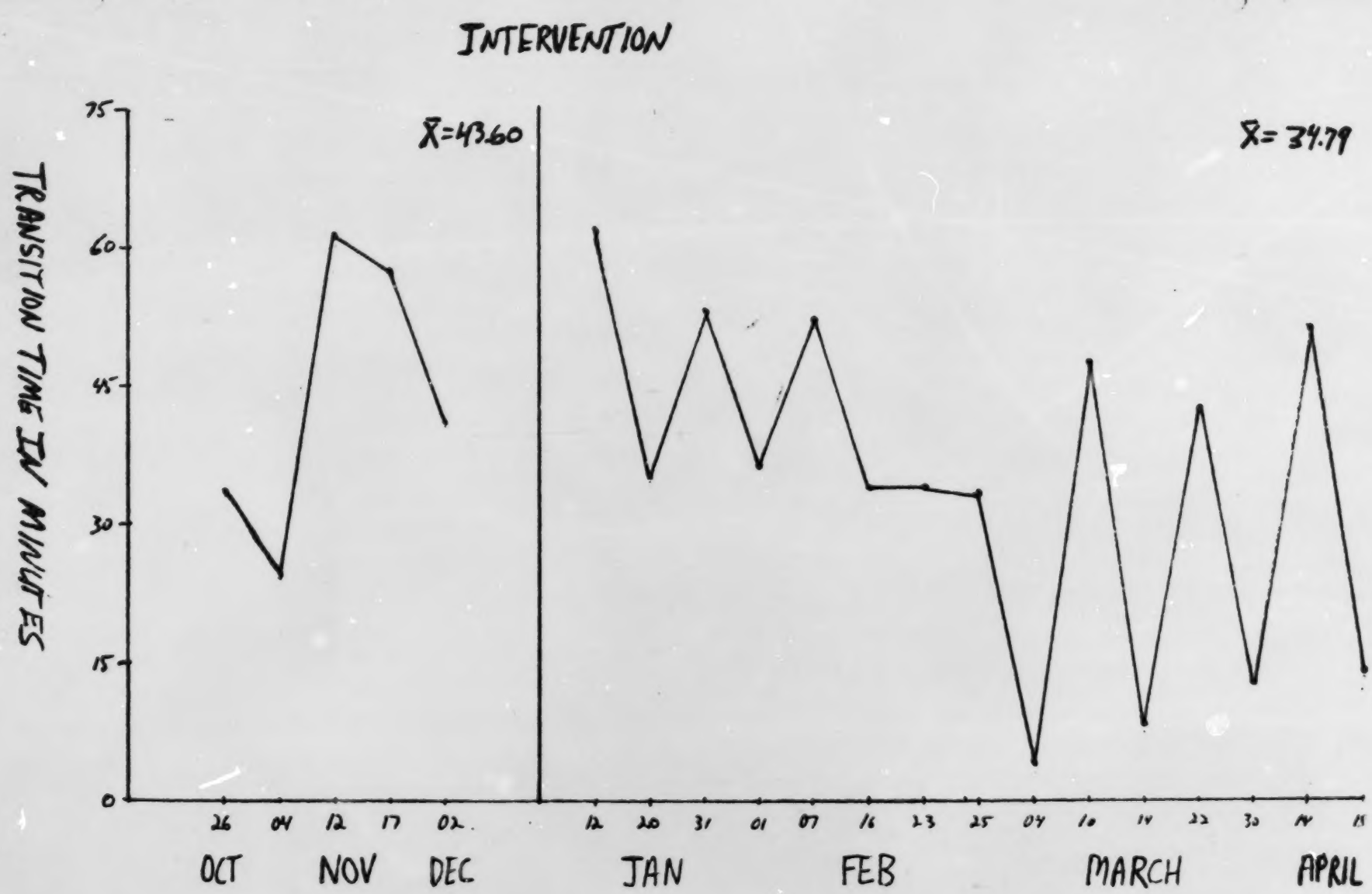

FIGURE 1. PRE AND POST INTERVENTION RECORD OF TRANSITION TIME (IN MINUTES) FOR TEACHER S.

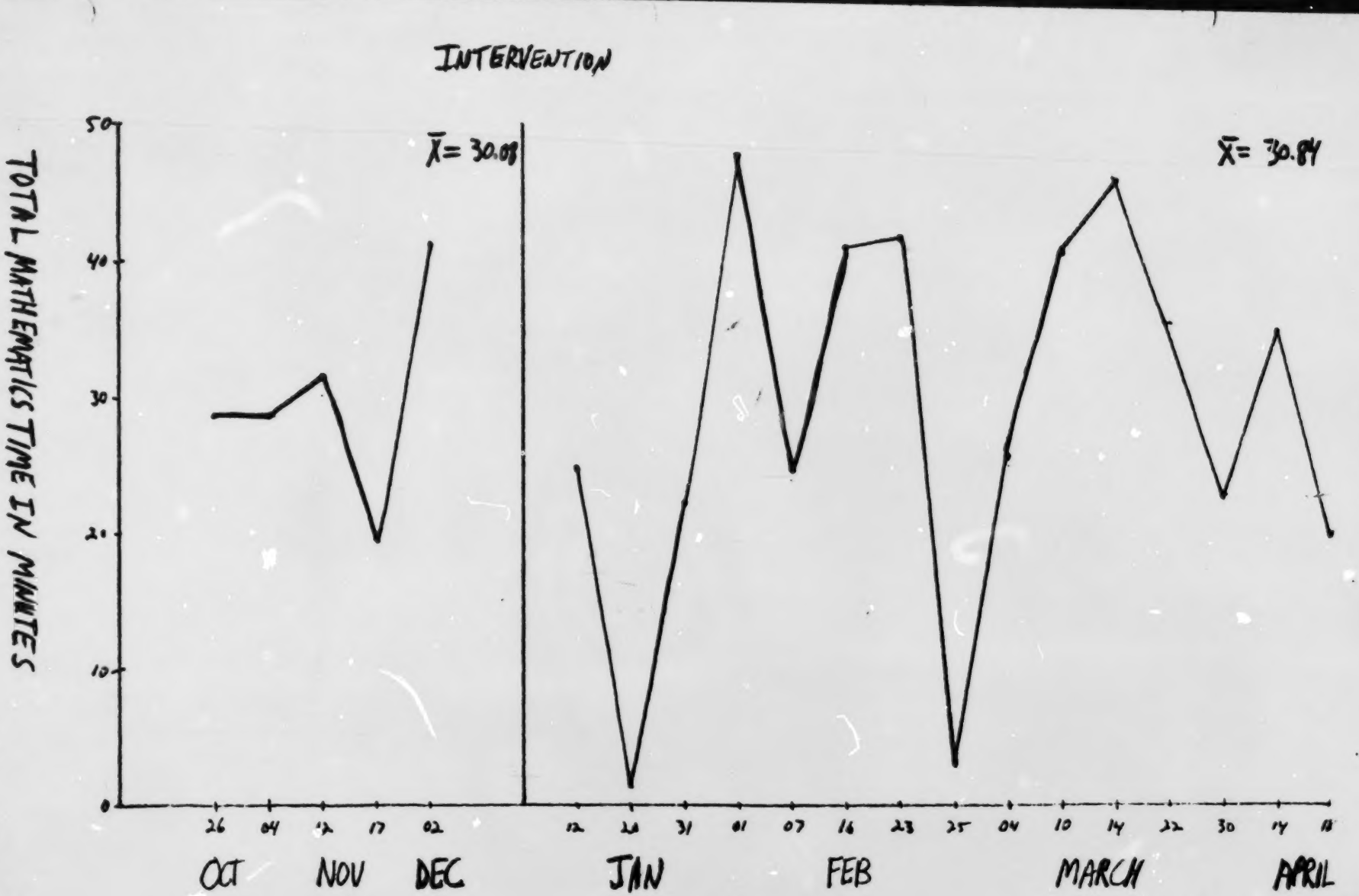

FIGURE 2. PRE AND POST INTERVENTION RECORD OF TOTAL MATHEMATICS TIME (IN MINUTES) FOR TEACHER 5.

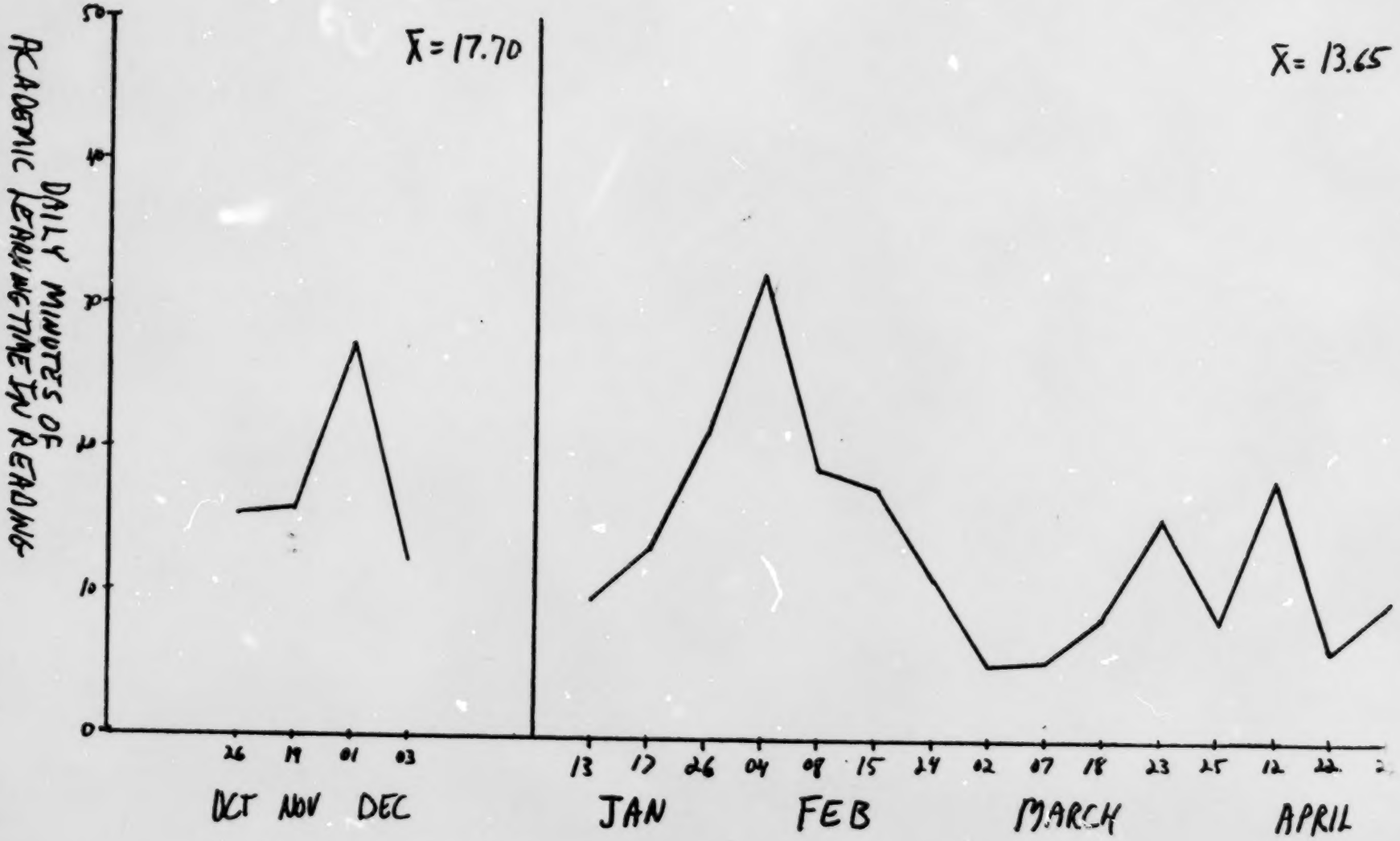
DAILY MINUTES OF ACADEMIC LEARNING TIME IN READING
X = 17.70
X = 13.65
0
10
20
26 19 01 03
OCT NOV DEC
13 17 26 04 09 15 24 02 07 18 23 25 12 22
JAN FEB MARCH APRIL

FIGURE 3. PRE AND POST INTERVENTION RECORD OF ACADEMIC LEARNING TIME (IN MINUTES) FOR READING WITH TEACHER 4.

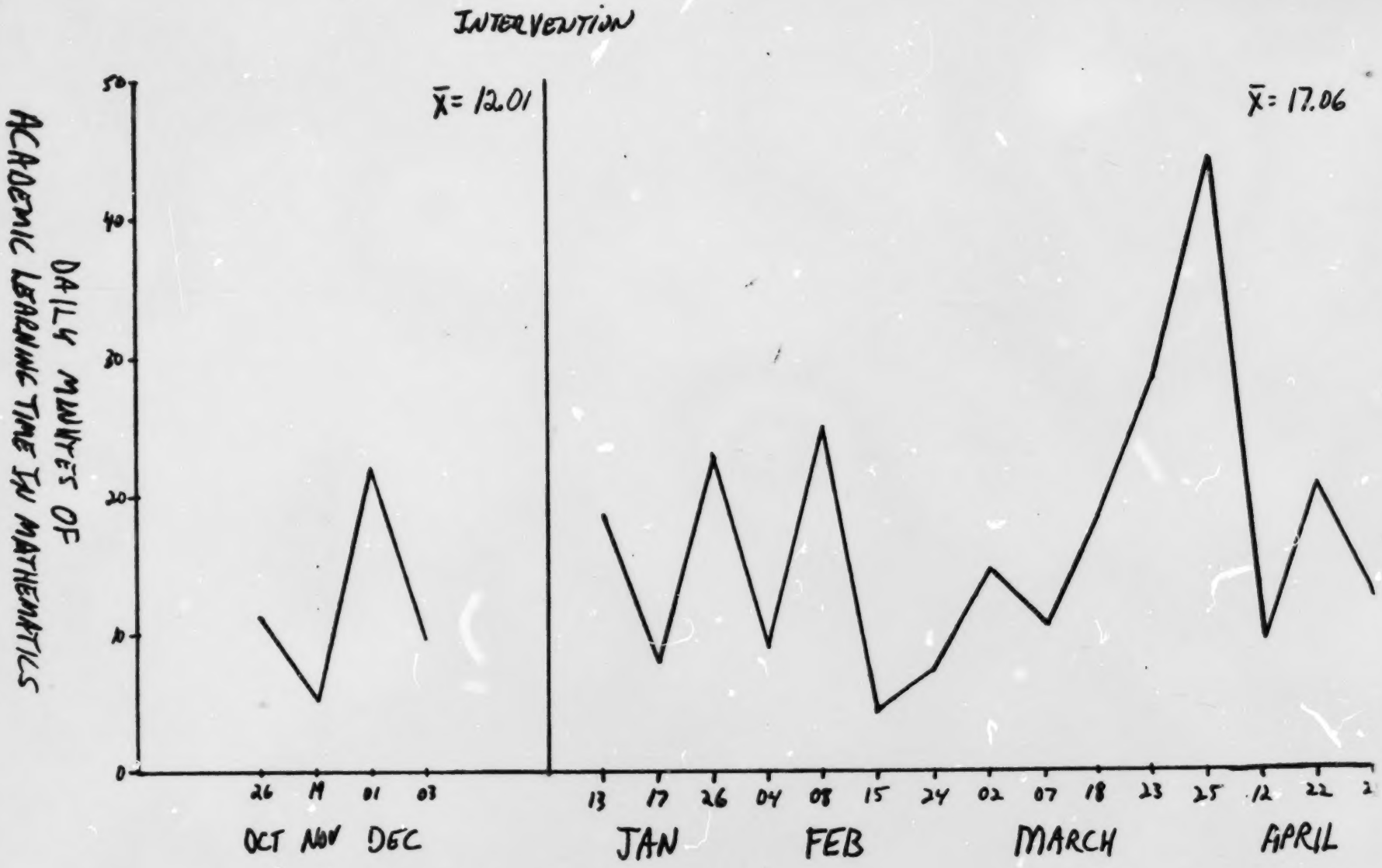

FIGURE 4. PRE AND POST INTERVENTION RECORD OF ACADEMIC LEARNING TIME (IN MINUTES) FOR MATHEMATICS WITH TEACHER 4.

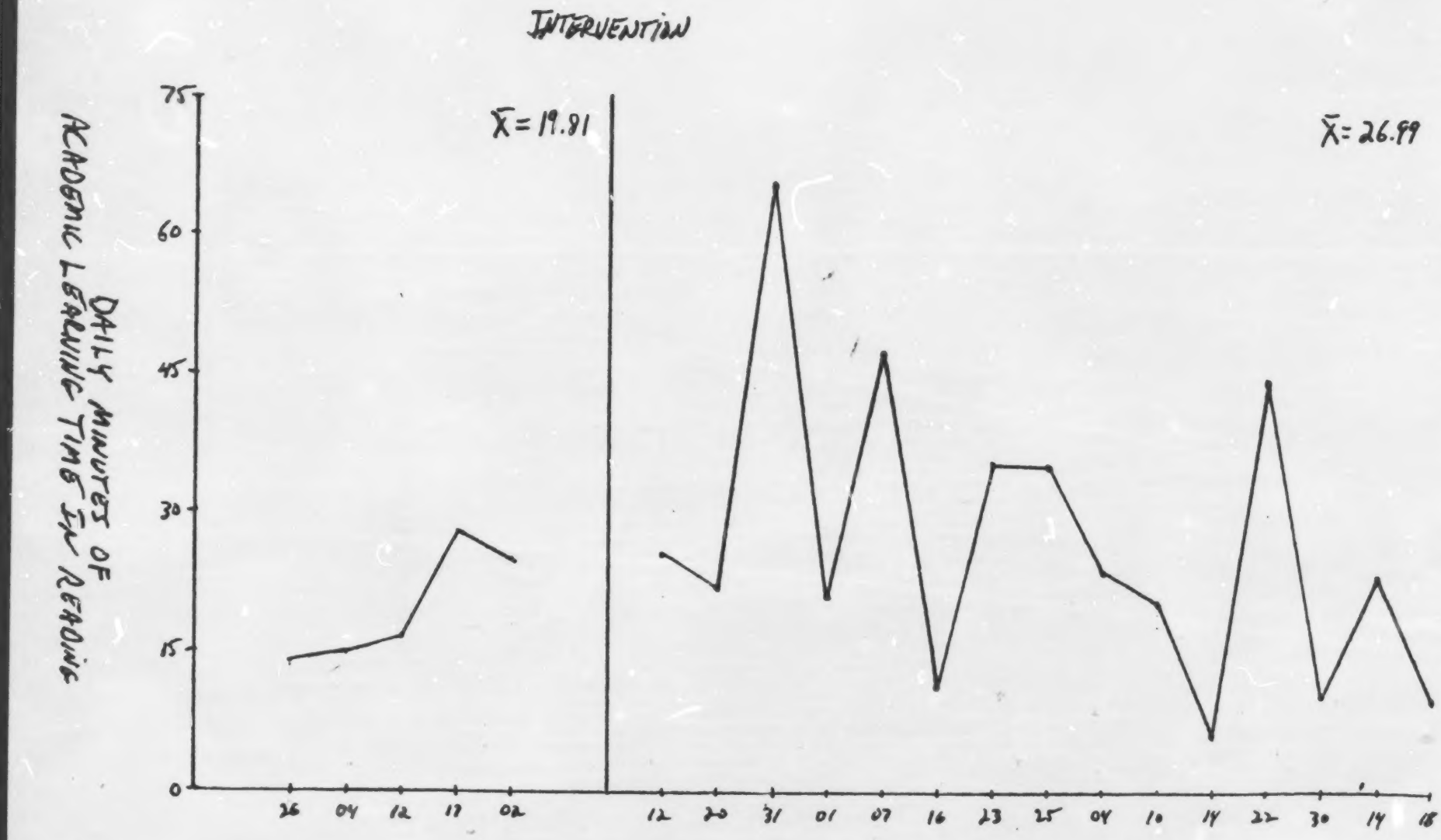

FIGURE 5. PRE AND POST INTERVENTION RECORD OF ACADEMIC LEARNING TIME (IN MINUTES) FOR READING WITH TEACHER 5.

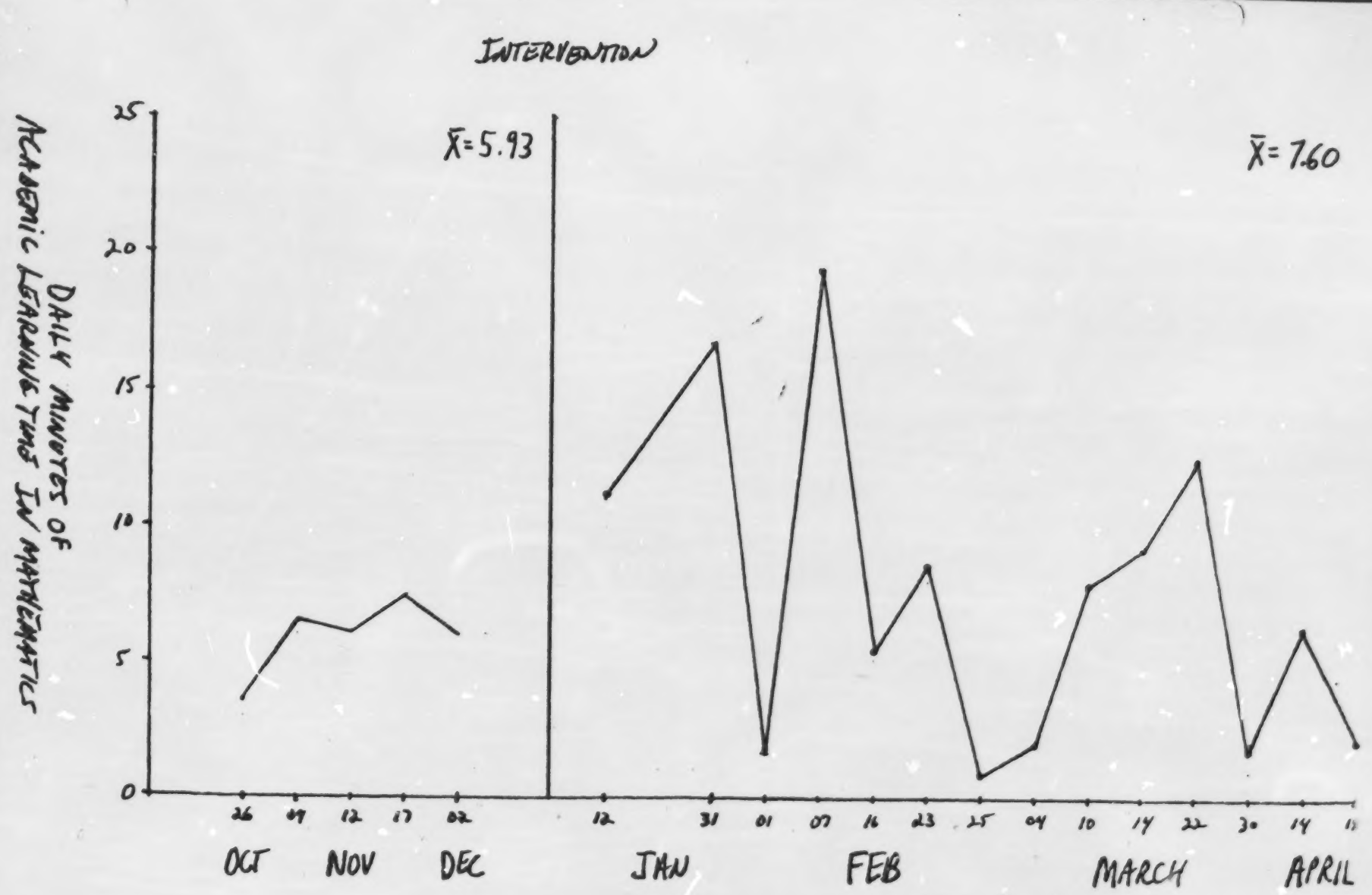

FIGURE 6. PRE AND POST INTERVENTION RECORD OF ACADEMIC LEARNING TIME (IN MINUTES) FOR MATHEMATICS WITH TEACHER 5.

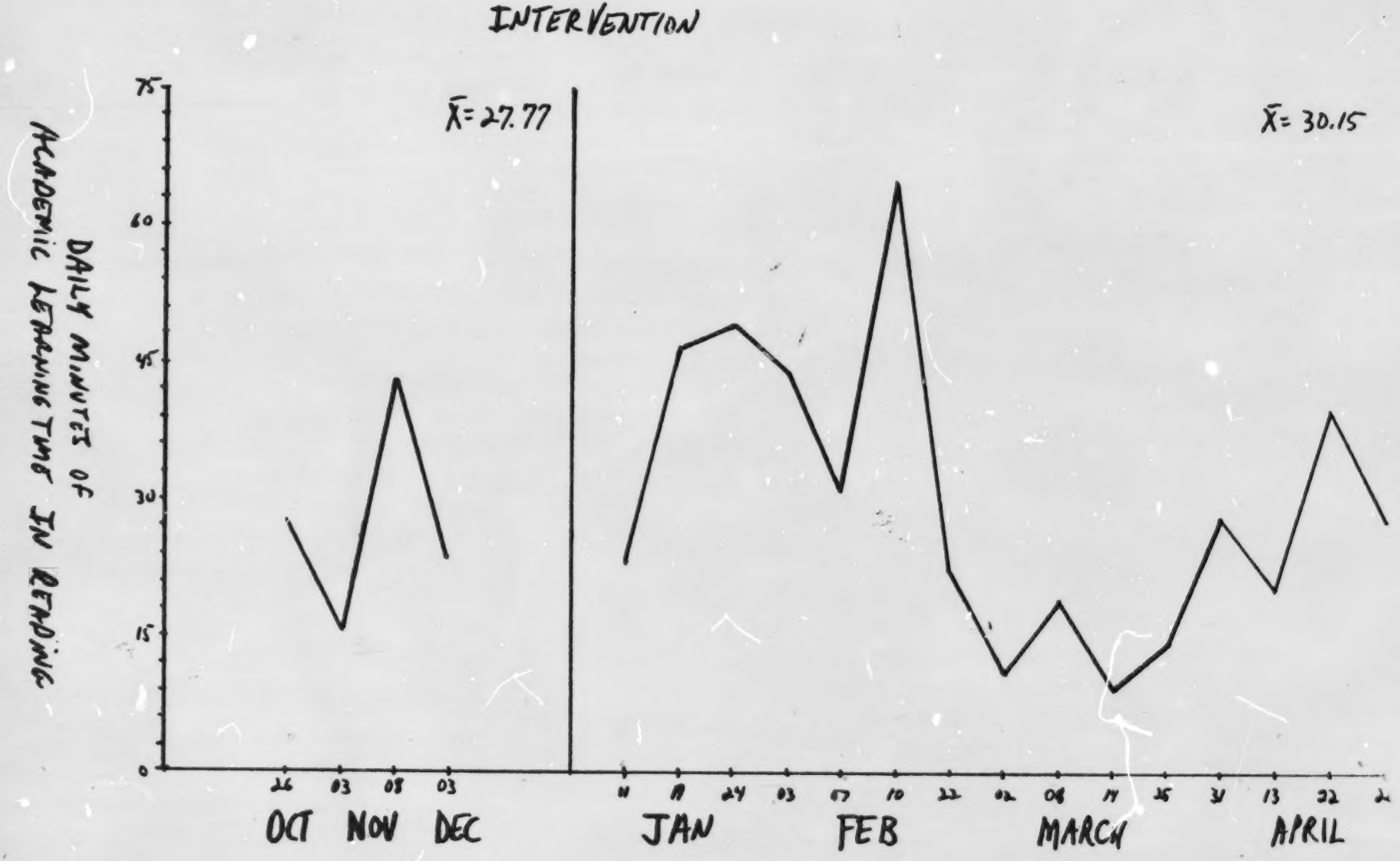

FIGURE 7. PRE AND POST INTERVENTION RECORD OF ACADEMIC LEARNING TIME (IN MINUTES) FOR READING WITH TEACHER 9.

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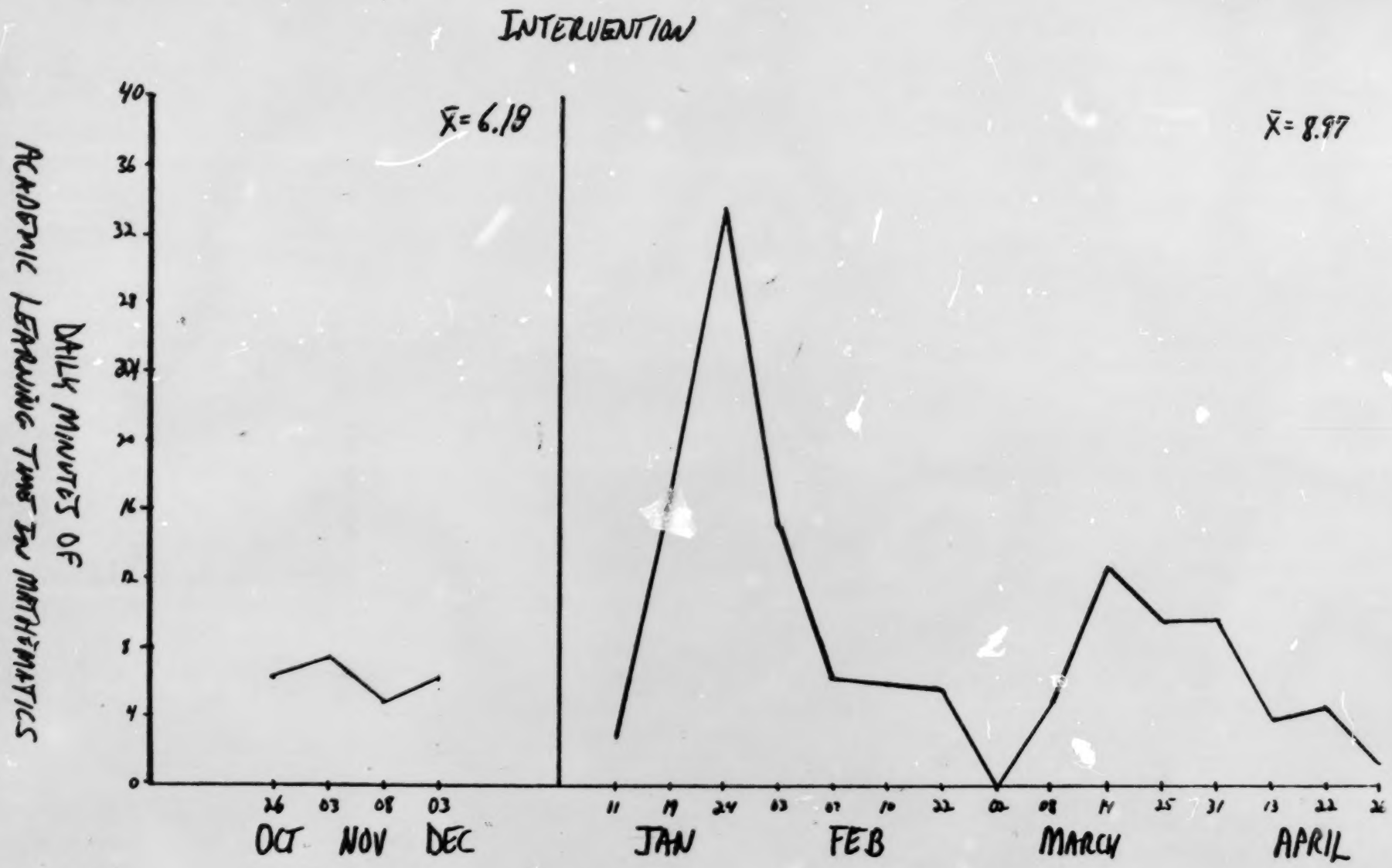

FIGURE 8. PRE AND POST INTERVENTION RECORD OF ACADEMIC LEARNING TIME (IN MINUTES) FOR MATHEMATICS WITH TEACHER 9.

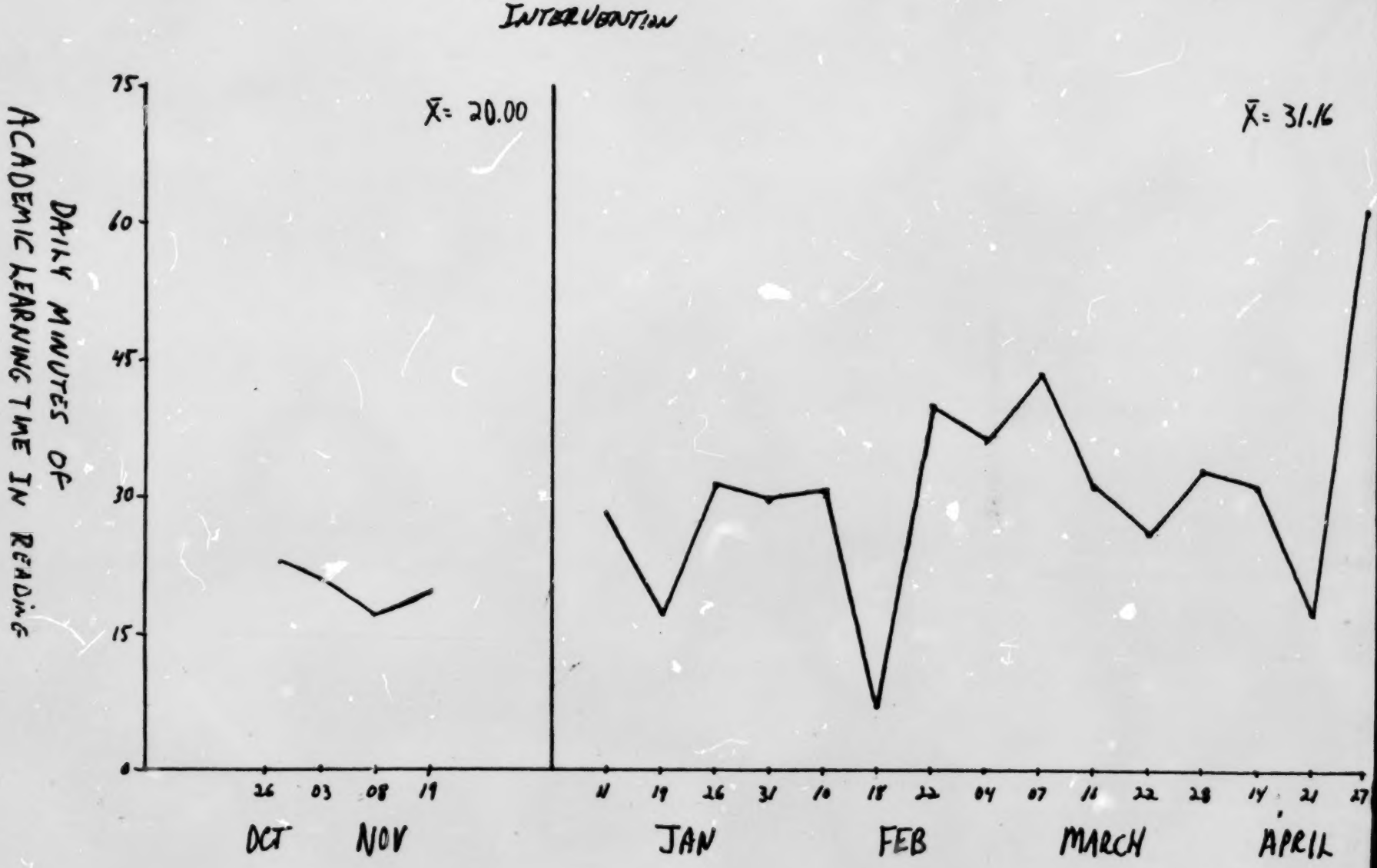

FIGURE 9. ARE AND POST INTERVENTION RECORD OF ACADEMIC LEARNING TIME (IN MINUTES) FOR READING WITH TEACHER 15.

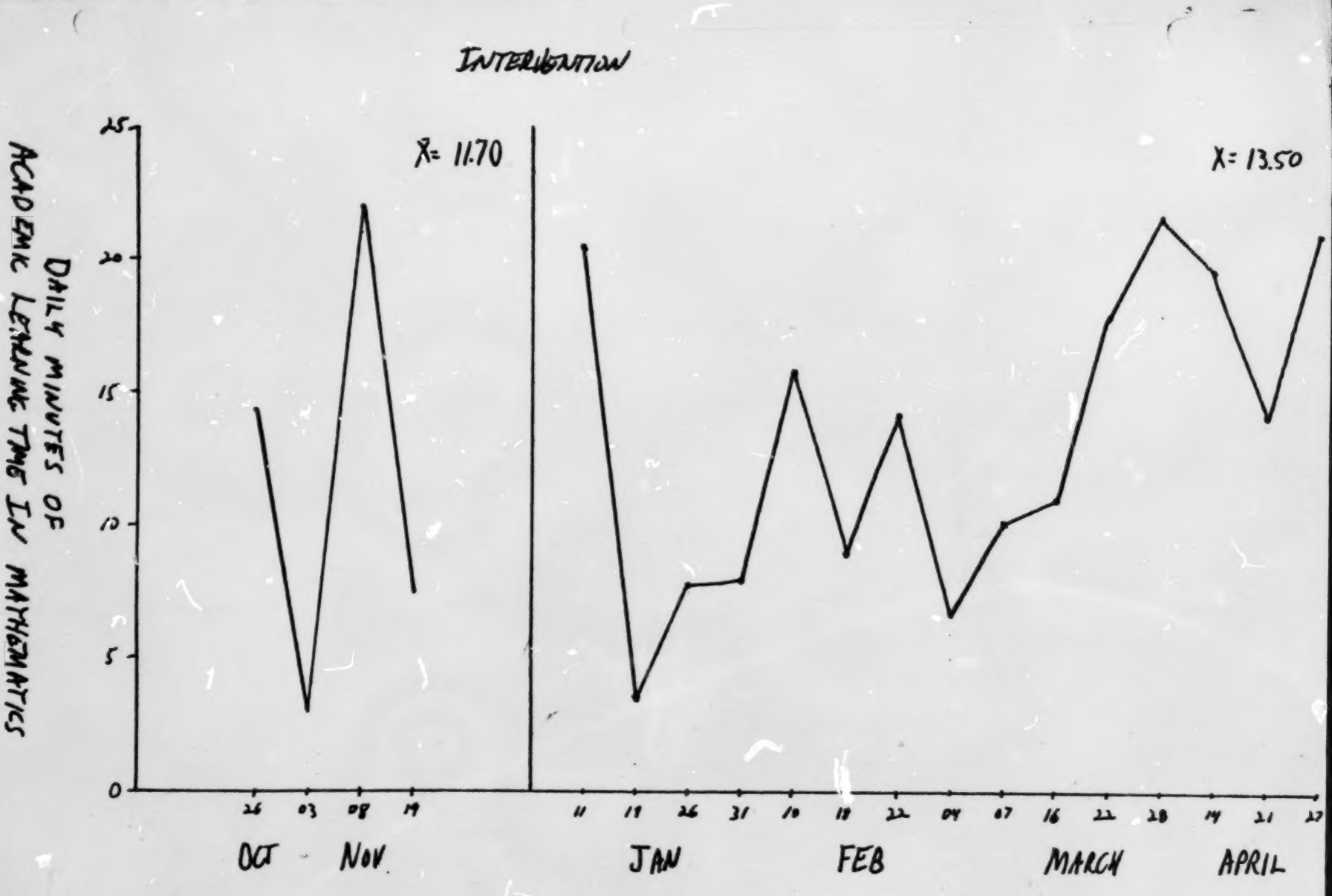

FIGURE 10. PRE AND POST INTERVENTION RECORD OF ACADEMIC LEARNING TIME (IN MINUTES) FOR MATHEMATICS WITH TEACHER 15.

Table 1

Mean Wait Time in Minutes

	A Time Period	B Time Period	Difference
Intervention Classes	5.5	6.3	+.8
Workshop Classes	5.3	5.7	+.4
Control Classes	3.2	2.6	-.6

Table 2.

Mean Transition Time in Minutes

	A Time Period	B Time Period	Difference
Intervention Classes	36	37	+1
Workshop Classes	39	36	-3
Control Classes	31	32	+1

Table 3

Mean Allocated Time in Reading

	A Time Period	B Time Period	Difference
Intervention Classes	73.5	82.3	+8.8
Workshop Classes	80.4	84 9	+4.5
Control Classes	89.4	90.5	+1.1

Table 4

Mean Allocated Time in Mathematics

	A Time Period	B Time Period	Difference
Intervention Classes	37.8	40.5	+2.7
Workshop Classes	32.1	38.0	+5.9
Control Classes	40.2	34.3	-5.9

Table 5

Mean Percent of Time Engaged in Reading

	A Time Period	B Time Period	Difference
Intervention Classes	.63	.66	+.03
Workshop Classes	.74	.75	+.01
Control Classes	.76	.75	-.01

Table 6

Mean Percent of Time Engaged in Mathematics

	A Time Period	B Time Period	Difference
Intervention Classes	.61	.64	+.03
Workshop Classes	.68	.71	+.03
Control Classes	.77	.73	-.04

Table 7

Mean Percent of Time in Activities of Intermediate Level Difficulty in Reading

	A Time Period	B Time Period	Difference
Intervention Classes	.51	.50	-.01
Workshop Classes	.38	.46	+.06
Control Classes	.43	.43	0.00

Table 8

Mean Percent of Time in Activities of Intermediate Level Difficulty in Mathematics

	A Time Period	B Time Period	Difference
Intervention Classes	.43	.45	+.02
Workshop Classes	.38	.50	+.12
Control Classes	.41	.43	-.02

Table 9

Academic Learning Time in Reading

	A Time Period	B Time Period	Difference
Intervention Classes	21.0	26.5	+5.5
Workshop Classes	24.3	30.3	+6.0
Control Classes	29.2	29.1	-0.1

Table 10

Academic Learning Time in Mathematics

	A Time Period	B Time Period	Difference
Intervention Classes	9.6	11.6	+2.0
Workshop Classes	9.1	14.2	+5.1
Control Classes	12.6	10.9	-1.7

Table 11

Mean Minutes of Engaged Time in Reading Per Day

	A Time Period	B Time Period	Difference
Intervention Classes	46.3	54.3	+8.0
Workshop Classes	59.5	63.7	+4.2
Control Classes	67.9	67.9	0

Table 12

Mean Minutes of Engaged Time in Mathematics Per Day

	A Time Period	B Time Period	Difference
Intervention Classes	23.2	25.9	+2.7
Workshop Classes	21.9	26.8	+4.9
Control Classes	30.8	25.1	-5.7

An Analysis of Instructional Time in Grade 2 Mathematics

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Far West Laboratory for Educational
Research and Development

An Analysis of Instructional Time in Grade 2 Mathematics

Introduction

In the past several years, there has been a remarkable upsurge in interest and research activity concerning instructional time. This seems especially true of those examining elementary school instruction. For some, the trend has value because it offers a practical way of looking at differences in educational opportunity. For others, the trend maybe associated with the current emphasis on basic skills in elementary education. Whatever their reasons, a wide variety of people are examining patterns of classroom time use from quite different points of view.

During the past three years we have been collecting data on instructional time in elementary school classrooms. Our initial interest was in examining relations between time and learning. We thought that, quantity of instruction should be an important contribution to gains in student achievement. We soon realized that the term instructional time could have many different meanings. For example, a recent study reported that students receive 36 minutes (on the average) of mathematics instruction per day, (Fisher, Filby, & Marliave, 1977). What does this mean? From the point of view of the student, the experience of daily mathematics instruction maybe very different from one class or setting to the next. Knowledge about the duration of an instructional event maybe interesting, but what events should be examined (and in how much detail) in order to provide useful information for instructional theory and practice.

We began by looking at time allocated to specific content categories. It is soon became clear that this simple index of instructional events showed marked differences from class to class. It also became clear that the definition of instructional time could be refined and elaborated so that other

important features of instruction could be taken into account.

This paper has two main purposes. First, we will describe the pattern of time allocation to two specific mathematics content areas. Second, we will illustrate how student engagement rates and error rates maybe examined in conjunction with allocated time to provide a useful index of instruction.

Time data were collected as part of the field work associated with the Beginning Teacher Evalaution Study (BTES)[1] being conducted by the Far West Laboratory for Educational Research and Development. Phase III-B of this study examined the relationship of teaching behaviors, academic learning time and student achievement in reading and mathematics at grades 2 and 5, (Fisher, Filby, Marliave, Cahen, Dishaw, Moore, & Berliner, in press). We would like to focus attention on a small set of time data taken from this study.

Allocated Time

Teacher logs were used to assess the amount of time allocated to each of 14 mathematics content areas each day over 17 weeks of instruction. Teachers recorded the time allocated to each content area for each of six target students in each of 25 classes (Dishaw, 1977a, b). Table 1 presents the mean time allocated to two of the content areas for each class. Note the large differences among the class means. For example, class 08 has more than seven times as much time allocated to addition and subtraction (no regrouping) as class 17. These data are in themselves of considerable interest. Even if we know nothing else about the instructional features of student experiences in these classes, it is apparent that they differ quite markedly. Means frequently obscure the pattern of experiences for

[1] BTES is sponsored by the California Commission for Teacher Preparation and Licsnsing (CCTPL) and the National Institute of Education (NIE).

Table 1

Time allocated to selected mathematics content areas over 17 weeks of instruction (Grade 2)

Class Number	CONTENT CATEGORY		
	Addition and Subtraction (No Regrouping)	Place Value	Total Mathematics
01	320	271	1888
02	269	423	2396
03	247	301	2977
04	263	619	2132
05	626	331	1844
06	593	19	2399
07	358	159	2458
08	1263	386	3319
09	738	261	3094
10	341	411	2993
11	658	245	2662
12	316	521	2664
13	372	250	3816
14	274	196	2801
15	324	238	3543
16	201	30	1439
17	171	462	2722
18	477	215	2191
19	687	341	2448
20	1030	547	3267
21	201	316	2161
22	819	243	2800
23	715	436	2512
24	320	356	3149
25	246	479	3218

Entries are in minutes. All data were collected via daily teacher logs.

specific children. Using allocated time as a simple index of instructional experience, let us examine the way in which these times were accumulated by individual students.

We selected five of the 139 second grade students participating in BTES to illustrate the different patterns of allocation of instructional time over the same 17 week period (January through April, 1977). Table 2 shows the cummulative time pattern for each of the five students for Addition and Subtraction (without regrouping). Pupil 0605 received 665 minutes of instruction in addition and subtraction over the 17 weeks; about twice the time allocated to the other pupils over the same period. An examination of the weekly accumulation of allocated time reveals interesting information about the instructional histories of these students. Student 1501 received no instruction in this content area after the 12th week. Student 0702 received no instruction after the 10th week. We are merely pointing out the different patterns of allocated time and are not attempting to state that these patterns reflect good or poor teaching strategies. If a student has reached satisfactory levels of competence, reallocation of time to other content areas seems appropriate.

Table 3 shows the cummulative record for allocated time in place value. Here the total time over the 17 week period ranged from 140 for pupil 0702 to almost 500 for pupil 0406. There is bound to be a certain amount of ipsativity in the time figures when all content areas are considered. If a pupil received almost all of his instruction in addition and subtraction, it limits the time available for other content areas. Table 3 shows that pupil 1501 received instruction in place value in weeks 5 and 17 only. Pupil 0702 received no time allocation after week 10.

Table 2

Time allocated to addition and subtraction (no regrouping) for 5 students over 17 weeks of instruction

Week	Student 0506		Student 0702		Student 1006		Student 1501		Student 0406	
	Raw	Cum	Raw	Cum	Raw	Cum	Raw	Cum	Raw	Cum
1	30	30	40	40	45	45	60	60	35	35
2	62	92	95	135	20	65	30	90	20	55
3	105	197	0	135	10	75	20	110	80	135
4	105	302	0	135	0	75	50	160	35	170
5	20	322	50	185	20	95	20	180	40	210
6	0	322	20	205	30	125	30	210	0	210
7	5	327	90	295	50	175	30	240	0	210
8	15	342	45	340	40	215	30	270	0	210
9	50	392	10	350	20	235	20	290	10	220
10	30	422	30	380	55	290	10	300	45	265
11	20	442	0	380	25	315	0	300	20	285
12	80	522	0	380	0	315	30	330	15	300
13	38	560	0	380	0	315	0	330	0	300
14	0	560	0	380	0	315	0	330	0	300
15	20	580	0	380	10	325	0	330	5	305
16	30	610	0	380	35	360	0	330	0	305
17	55	665	0	380	4	364	0	330	10	315

Entries are in minutes.

Table 3

Time allocated to place value for 5 students over 17 weeks of instruction

Week	Student 0506		Student 0702		Student 1006		Student 1501		Student 0406	
	Raw	Cum	Raw	Cum	Raw	Cum	Raw	Cum	Raw	Cum
1	30	30	85	85	10	10	0	0	0	0
2	0	30	0	85	65	75	0	0	103	103
3	15	45	0	85	50	125	0	0	0	103
4	0	45	15	100	0	125	0	0	25	128
5	25	70	0	100	20	145	120	120	30	158
6	53	123	0	100	50	195	0	120	65	223
7	45	168	0	100	105	300	0	120	0	223
8	15	183	0	100	35	335	0	120	150	373
9	10	193	0	100	20	355	0	120	30	403
10	0	193	40	140	0	355	0	120	20	423
11	15	208	0	140	35	390	0	120	5	428
12	30	238	0	140	0	390	0	120	40	468
13	30	268	0	140	15	405	0	120	15	483
14	0	268	0	140	0	405	0	120	0	483
15	15	283	0	140	10	415	0	120	0	483
16	30	313	0	140	0	415	0	120	15	498
17	30	343	0	140	5	420	50	170	0	498

Entries are in minutes.

These differences in allocated time are quite striking. We believe that this type of descriptive information has important implications. For example, consider the assessment of learning via written tests. The selection of times to administer tests "catches" students at many different stages of instruction. A test of place value given in the 18th week would be a retention test for student 0702 but not for the other students.

We have seen that the amount of time allocated to specific content areas varies quite markedly across students in different classes. The exposure of students to instruction in particular areas (their opportunity to learn) is greatly affected by these differences in time allocations. We have also noted that the pattern of allocation of time over days and weeks shows remarkable variability. Taking time allocation as one admittedly simple description of school experience, students are exposed to very different patterns of accumulation and receive very different amounts of time in specific content areas.

Engaged Time

Not all of the time which is allocated to a particular content area is, in fact, used by the student on learning tasks. During each instructional period, a given student will attend to the task at hand for part of the time, and will be unengaged or off-task for some of the time. In our study we used a direct observation system to assess the amount of time students were engaged during mathematics instruction. By dividing engaged time by total time in mathematics we generated an engagement rate for each student. Table 4 lists engagement rates for the five students. Applying these rates to the overall amount of allocated time we can estimate the amount of time students were engaged on tasks relevant to addition and substraction (without regrouping) during the seventeen week period. Table 5 contains

Table 4

Observed engagement rates and error rates for 5 students during grade 2 mathematics instruction

Student	Sex	Engagement Rate	Proportion of Time on Tasks w/ Low error rate
0506	M	.66	.44
0702	M	.87	.58
1006	F	.51	.09
1501	F	.36	.23
0406	F	.60	.3[illegible]

Table 5

Allocated time, engaged time, and time on tasks with low error rates in two mathematics content areas

Student	Addition and Subtraction (No Regrouping)				Place Value			
	Allocated Time	Engaged Time	Time on Tasks with Low Error Rate	Engaged Time with Low Error Rate	Allocated Time	Engaged Time	Time on Tasks with Low Error Rate	Engaged Time with Low Error Rate
0406	315	189	113	68	498	299	179	108
0506	665	439	293	193	343	226	151	100
0702	380	331	220	192	140	122	81	71
1006	364	186	33	17	420	214	38	19
1501	330	119	76	27	170	61	39	14

Note: Entries in the table are minutes accumulated over seventeen weeks of instruction covering the period January through April. Students were members of different grade 2 classes.

these estimates. Each row represents a student. The first column lists the total allocated time for addition and subtraction (without regrouping). The second column contains the amount of time during which students were engaged in the instructional activity. Note that the engaged times are very different from the allocated times and that the rank ordering among the students changes from column one to column two. Because a student is allocated more time in a particular content area does not necessarily mean that that student will spend more time engaged on tasks relevant to the area. These simple data provide considerable insight into the instructional experiences of children. The data raise very important questions about instruction. For example, what are the student and teacher characteristics that affect engagement rates? What characteristics of the classroom group and classroom context affect these rates? How much variation is there in engagement from classroom setting to classroom setting? What kinds of teaching behaviors are related to variations in engagement?[2]

Error Rate

Another facet in describing the school experience of students concerns the relative difficulty of the tasks on which the student spends time. By direct observation we estimated the proportion of time in mathematics instruction during which students made few errors, a medium number of errors, or a high number of errors. It is important to note that we assessed this facet in terms of each student's behavior as opposed to assessing error rates characteristic of the tasks. We have found that students who spend greater proportions of their time on tasks on which they show a low error

[2]Analyses bearing on a number of these questions have been carried out on BTES data (see Filby & Cahen, 1978; Marliave, Fisher, & Dishaw, 1978; Berliner, Filby, Marliave, & Weir, 1978; and Fisher, et al., in press).

rate also tend to have higher achievement gain, (Marliave, Fisher, & Dishaw, 1978). For this reason we are focusing attention on the time students spend on tasks with low error rates. This does not necessarily mean that students should spend all of their time on tasks with low error rates and no time on somewhat more challenging tasks. The proportions of time spent on tasks with low error rates during mathematics instruction are shown for the five students in Table 4. By applying these rates to times allocated to specific content areas we can estimate the amount of time spent on tasks with low error rates for each student over the 17 week period. These estimates are shown in columns 4 and 8 on Table 5 for addition and subtraction (without regrouping) and place value respectively. Note that the amounts of time and the rank ordering of students change from one column to another in the table.

Academic Learning Time

If we further estimate the amount of time which students spend engaged on tasks with low error rates we see some startling changes from the column of allocated times. Columns 5 and 9 in Table 5 were obtained by applying both the engagement and error rate information to the allocated time data. Note that student 0506 who had almost twice as much time allocated to addition and subtraction (without regrouping) as student 0702, experiences the same amount of time which is engaged on tasks with low error rates. Also students 0702 and 1006 who started with similar amounts of allocated time in addition and subtraction (no regrouping) spend quite different amounts of time engaged on tasks with low error rates.

These facets (allocated time, engagement rate, and error rate) constitute what we call academic learning time. We hypothesize that increasing

academic learning time leads to increased achievement. That is, students who spend more time engaged on tasks with low error rates in a particular content area will tend to have higher achievement in that content area.

The data in Table 5 have been converted into bar graphs and are displayed in Figures 1 and 2. Each bar represents a student. A total bar represents allocated time, the cross hatched area plus the solid area represents engaged time and the solid area represents academic learning time.

These distributions, even for five students, illustrate that large differences exist in the amount of academic learning time which students accumulate in classroom instruction. Academic learning time provides a useful way to conceptualize school experience. The questions raised earlier in the context of engagement rates are also appropriate for academic learning time. What characteristics of students, teachers, and classroom context affect the distribution of academic learning time for students? How much can academic learning time be modified by classroom conditions and instructional interventions? How much is academic learning time affected by the structure of classroom activities? Do group size, pacing, and degree of individualization have pronounced impacts on academic learning time?

We believe that the investigation of classroom process in terms of the facets of academic learning time is both practically and theoretically important. This is especially true if researchers pay attention to the way which school experience is accumulated, that is, to the time sequence of classroom events.

Summary

This paper illustrates some of the complexities of understanding student learning time. We have shown that students received dramatically different amounts of allocated time over a 17 week period. In addition to receiving

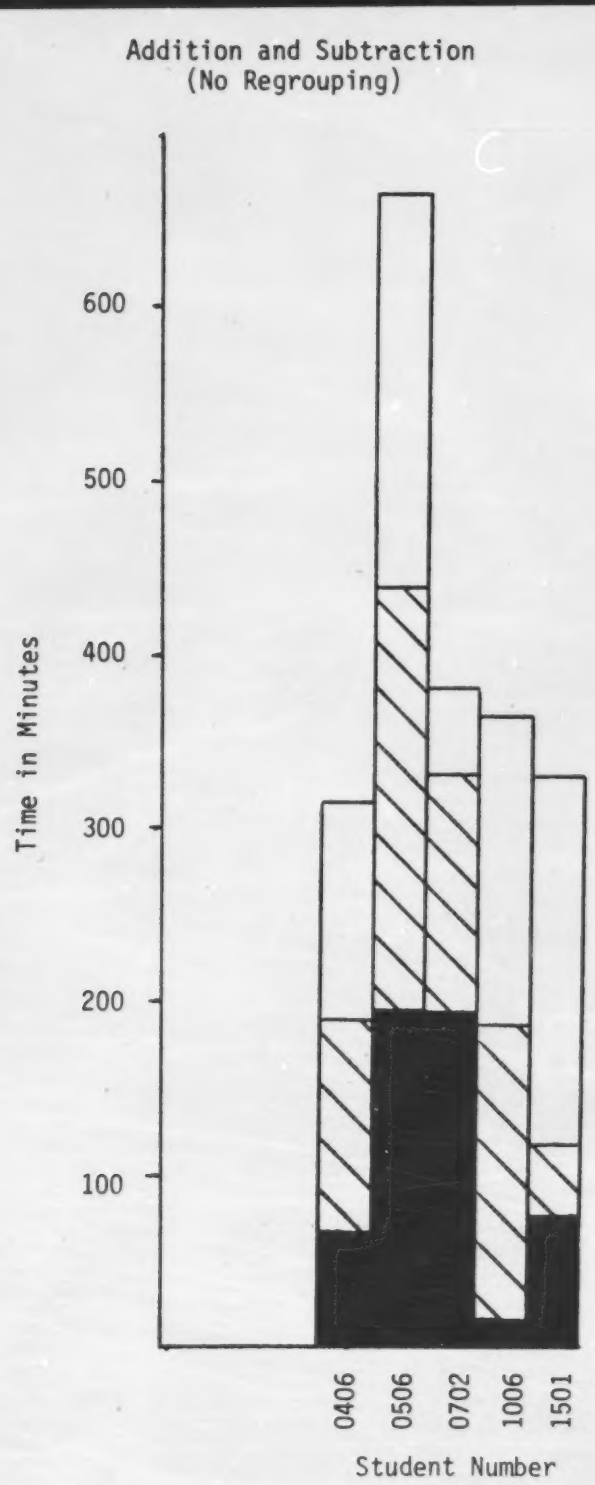

Figure 1 Allocated time, engaged time, and engaged time on tasks with low error rate for 5 students.

Note: Times are in minutes accumulated over 17 weeks of instruction.

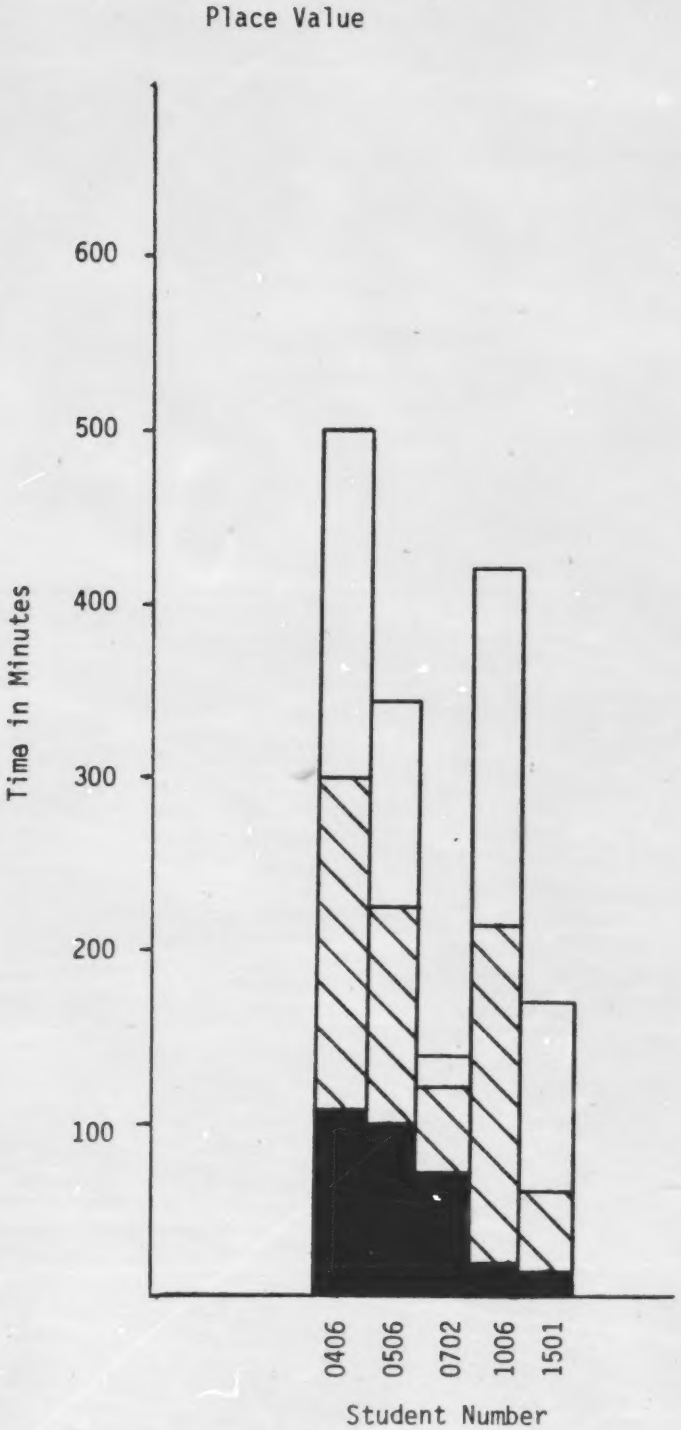

Figure 2 Allocated time, engaged time, and engaged time on tasks with low error rate for 5 students.

Note: Times are in minutes accumulated over 17 weeks of instruction.

different total allocations over the 17 week period, an examination of the week by week allocations reveals vastly different patterns. Examples were provided where students received more or less constant allocations over weeks. Other students received no instruction after the tenth or twelfth week, and one student received all of his instruction in only two of the 17 weeks.

It is obvious to anyone who has been a student, or who has observed classroom learning, that there is a difference between "clock time" and the amount of time spent in actual learning. We have attempt to define and estimate more precisely the true learning time. We adjust the allocated time using engagement rates and preparation of time during which the pupil proceeds with few errors. This procedure allowed us to estimate the amount of academic learning time. Differences between the amount of allocated time and academic learning time were relatively large and altered the ranking of students.

From our work on the BTES we have become acutely aware of the complexities of instructional time. We believe that there is utility in examining the quantity of instruction available to students. We must continue to refine our descriptions of instructions so that quality of instruction is addressed. We must define more clearly the instructional events whose duration we measure. For the purpose of understanding classroom learning, progressively more complex descriptions of instructional processes will be necessary.

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Fisher, C.W., Filby, N.N., Marliave, R.S., Cahen, L.S., Dishaw, M.M., Moore, J.E. and Berliner, D.C. Teaching behaviors, academic learning time and student achievement: Final report of Phase III-B, Beginning Teacher Evaluation Study. Far West Laboratory for Educational Research and Development, San Francisco, in press.

Marliave, R.S., Fisher, C.W. and Dishaw, M.M. Academic learning time and student achievement in the B-C period (Technical Note V-2a). Beginning Teacher evaluation Study, Far West Laboratory for Educational Research and Development, San Francisco, 1978.

APPENDIX A

BEGINNING TEACHER EVALUATION STUDY (BTES)

Technical Reports and Notes

for

Phase III-A
Phase III-A Continuation
Phase III-B

This appendix presents an annotated list of documents produced during the conduct of Phase III-A, Phase III-A Continuation and Phase III-B of the BTES.

BEGINNING TEACHER EVALUATION STUDY
(BTES)

Phase III-A Technical Reports and Notes

Berliner, David C. Impediments to the study of teacher effectiveness. San Francisco, California: Technical Report 75-11-3, Beginning Teacher Evaluation Study, Far West Laboratory for Educational Research and Development, 1975. (29 pages)

This paper outlines problems associated with the independent and dependent variables used in studies of teaching, and related problems in the scientific study of teacher effectiveness. The conclusions reached are that empirical links between teacher behavior and student achievement will be very difficult to establish in the foreseeable future. (This paper, in modified version, is published in the Journal of Research in Science Teaching, 1976, in press; and with their permission, in the Journal of Teacher Education, 1976).

Berliner, D.C. The Beginning Teacher Evaluation Study: Overview and selected findings 1974-1975. San Francisco, California: Beginning Teacher Evaluation Study, Far West Laboratory for Educational Research and Development, 1975. (27 pages)

This paper presents a brief description of major tasks engaged in during the first year of research on this project by the Laboratory. The ethnographic study is discussed in some detail as an example of one research activity of unique interest to educational researchers. (Published as The California Beginning Teacher Evaluation Study: Overview of the Ethnographic Study, by Berliner, D.C. and Tikunoff, W.J., Journal of Teacher Education, 1976).

Berliner, David C., Filby, N. N., Marliave, R.S., Moore, J.L., and Tikunoff, W. J. Experimental teaching units and the identification of a special sample of classrooms for conducting research on teaching. San Francisco, California: Technical Report 76-12-1, Beginning Teacher Evaluation Study, Far West Laboratory for Educational Research and Development, 1976. (44 pages plus appendices)

To study the teaching-learning process in classrooms, a small sample of carefully selected teachers at the second and fifth grades were identified for one Phase of the Beginning Teacher Evaluation Study. A unique characteristic of this sample was that it included twenty teachers identified as relatively more effective in influencing achievement gains in their classes and twenty teachers identified as relatively less effective in their ability to teach certain objectives. Procedures and data related to the identification of these two disparate groups of teacners from a larger sample are described in this report. The teachers in the larger sample taught two week units in reading and mathematics, Experimental Teaching Units, and students completed pre and post tests. The smaller sample was selected based on information obtained from the student tests and classroom observations.

Berliner, D.C. and Rosenshine, B. The acquisition of knowledge in the classroom. San Francisco, California: Technical Report IV-1, Beginning Teacher Evaluation Study, Far West Laboratory for Educational Research and Development, 1976. (37 pages)

This paper addresses the issue of how learning in classrooms takes place. The effects of different curriculum and different teaching methods in knowledge acquisition is examined, both as main effects and in interaction with student aptitudes. The role of the teacher in communicating the knowledge to be acquired is described. Teachers are viewed as effective in helping students acquire knowledge if they engage in direct instruction. Components of direct instruction are described and data on their relationship to outcomes is presented. (Published in R.C. Anderson, R.J. Spiro, and W.E. Montegue (eds) Schooling and the Educational Process, Hillsdale, New Jersey: Earlbaum Associates, 1976, in press).

Erlich, Oded, and Shavelson, Richard . The Application of Generalizability Theory to the Study of Teaching. San Francisco, California: Technical Report 76-9-1, Beginning Teacher Evaluation Study, Far West Laboratory for Educational Research and Development, September 1976. (150 pages)

This report follows up a study of the stability of teacher behavior over occasions. After showing how classical test theory is inadequate for the problems of measurement in research on teaching, the newer theory of generalizability is presented. An illustrative generalizability study using a completely crossed design, is present. Examples of how variance estimates are obtained for the different design facets are also provided. A procedure is described which helps an investigator to determine the number of observations or raters necessary to determine stable estimates of teacher behavior so that generalizations about that behavior will be possible.

Harnischfeger, Annegret and Wiley, David E. Teaching-learning processes in elementary school: A synoptic view. San Francisco, California: Technical Report 75-3-1, Beginning Teacher Evaluation Study, Far West Laboratory for Educational Research and Development, 1975. (79 pages)

Studies of classroom teaching and learning are criticized for oversimplification. A conceptual framework is proposed, focusing on pupil instructional time in elementary school, exhaustively allocating it to learning pursuits, and tying these to teacher activities and pupil acquisition of knowledge and skill. The conceptual model attempts to establish a linkage between the social and the psychological conditions of learning, such that the implications of policy and classroom activity changes can be traced to pupil achievement. Teacher planning and implementation emerge as unexamined but vital foci for research on teaching. New policy-revelant school research and teacher evaluation priorities are advocated.

Joyce, Bruce. Variables, designs and instruments in the search for teacher effectiveness. San Francisco, California: Technical Report 75-10-4, Beginning Teacher Evaluation Study, Far West Laboratory for Educational Research and Development, 1975. (117 pages plus appendices)

This report provides a viewpoint about needed instrumentation and design considerations for the study of teaching. The basic questions addressed are: What variables should receive the greatest emphasis in the search for effective teachers? What kinds of designs are available and what are their advantages and disadvantages? And what instruments are available or must be developed to study teacher effectiveness? Discussed in this report are a) the close ties between the teacher and the curriculum materials, making attribution of effects very difficult; b) the ability of students in classrooms to effect teacher behavior as much as teacher behavior effects students. Students have the ability to elicit behavior as well as being the objects of that behavior; and c) the overlap of outcome measures in both reading and mathematics in the elementary grade levels.

Morine, Greta and Vallance, Elizabeth. Special Study B: A study of teacher and pupil perceptions of classroom interaction. San Francisco, California: Technical Report 75-11-6, Beginning Teacher Evaluation Study, Far West Laboratory for Educational Research and Development, 1975. (150 pages plus appendices)

Teachers were designated as more and less effective according to their ability to teach specially constructed reading and mathematics curriculum units over two weeks. They were then studied to determine if their perceptions of classroom interaction and interactive decision making were different. They were also studied to determine whether they notice different aspects of teaching when viewing instruction by another teacher. In addition, pupils were also studied to determine what aspects of instruction were salient to them. Four variables related to the teachers thinking about instruction were found worthy of further study. These were the teachers' a) logical/critical thinking, b) comparative thinking, c) negative thinking, and d) amount of input accepted or sought during interactive decision making. In addition, the examination of teacher and pupil perceptions of instruction also yielded variables worthy of further study. In particular, teachers with high pupil gain scores tended to emphasize cognitive aspects of the lesson more, while teachers with low pupil gain scores gave slightly more attention to affective aspects of the lesson. Furthermore, the most salient instructional characteristics for students were cognitive events, not affective events.

Morine, Greta and Vallance, Elizabeth. Special Study C: A study of teacher planning. San Francisco, California: Technical Report 76-3-1, Beginning Teacher Evaluation Study, Far West Laboratory for Educational Research and Development, 1976. (150 pages plus appendices)

Twenty more and twenty less effective teachers were studied to determine if they differed in the ways they plan for instruction. The effectiveness of the teachers was determined by their ability to affect gains in reading mathematics over two weeks of instruction with a specially designed curriculum unit. Four variables were noted as distinguishing between the planning of the more and less effective teachers. These were: a) whether the teacher used specific or general information in planning; b) whether the teacher believed students had the potential to learn the material; c) whether the teacher considered the cognitive aspects of instruction; and d) whether the teacher produced much of their own instructional materials.

Shavelson, Richard and Dempsey, Nancy. Generalizability of measures of teacher effectiveness and teaching process. San Francisco, California: Technical Report 75-4-2, Beginning Teacher Evaluation Study, Far West Laboratory for Educational Research and Development, 1975. (72 pages)

This report reviews studies of the stability of measure of teacher effectiveness and behavior. In studying teacher effectiveness over short intervals it appears that teaching the same content to similar students yields moderately stable generalizability coefficients over occasions. However, when teachers teach different content to the same or similar students, the measured effectiveness is not very stable over occasions. Studies of the stability of measured effectiveness over long time intervals yields very low to moderate stability coefficients. When the stability of the behavior of teachers was examined, global ratings appeared to show greater teacher stability over occasions than did frequency counts. Nevertheless, in general, there was very little evidence found to indicate that measures of teacher behavior over time are stable. Instability of teacher behavior seemed to be the common finding. Implications for research on teaching are presented.

Tikunoff, W.J., Berliner, D.C., and Rist, D.C. Special Study A: An ethnographic study of the forty classrooms of the Beginning Teacher Evaluation Study known sample. San Francisco, California: Technical Report 75-10-5, Beginning Teacher Evaluation Study, Far West Laboratory for Educational Research and Development, 1975.(120 pages plus appendices)

This report describes variables which differentiate the classrooms of more and less effective teachers. Teacher effectiveness was defined as the ability of second and fifth grade teachers to teach specially constructed reading and mathematics curriculum units over two weeks. Twenty more effective and twenty less effective teachers were visited for five days by specially trained ethnographers. Protocols of reading and mathematics instruction were prepared by the ethnographers. These protocols were rated and variables that distinguished between teachers of differential effectiveness were identified. Twenty-one of these variables were found to distinguish between the more and less effective teachers in their teaching of second grade reading, second grade mathematics, fifth grade reading and fifth grade mathematics. An additional 40 variables also showed some ability to differentiate between more and less effective teachers, but did not generalize across grade levels or subject matter areas. The use of a known sample of teachers varying in effectiveness, and the ethnographic procedures, were both methods found to be very useful in the study of classroom teaching.

Tikunoff, William J., Berliner, David C., and Rist, Ray C. Abstract from Special Study A: An ethnographic study of the forty classrooms of the Beginning Teacher Evaluation Study known sample. San Francisco, California: Technical Report 75-10-5(A), Beginning Teacher Evaluation Study, Far West Laboratory for Educational Research and Development. (19 pages)

This document briefly describes a study which is more fully reported in Technical Report 75-10-5, Special Study A: An Ethnographic Study of the Forty Classrooms of the Beginning Teacher Evaluation Study Known Sample. The report describes variables which differentiate the classrooms of more and less effective teachers. Teacher effectiveness was defined as the ability of second and fifth grade teachers to teach specially constructed reading and mathematics curriculum units over two weeks. Twenty more effective and twenty less effective teachers were visited for five days by specially trained ethnographers. Protocols of reading and mathematics instruction were prepared by the ethnographers. These protocols were rated and variables that distinguished between teachers of differential effectiveness were identified. Twenty-one of these variables were found to distinguish between the more and less effective teachers in their teaching of second grade reading, second grade mathematics, fifth grade reading and fifth grade mathematics. An additional

40 variables also showed some ability to differentiate between more and less effective teachers, but did not generalize across grade levels or subject matter areas. The use of a known sample of teachers varying in effectiveness, and the ethnographic procedures, were both methods found to be very useful in the study of classroom teaching.

Tikunoff, William J., Berliner, David C., and Rist, Ray C. Sample of Second Grade Classroom Protocols from Special Study A of the Beginning Teacher Evaluation Study. San Francisco, California: Beginning Teacher Evaluation Study, Far West Laboratory for Educational Research and Development, March-April, 1975. (13 pages plus appendices)

Sample of Second Grade Classroom Protocols Collected within this volume are examples of the protocols from grade 2 developed by the ethnographers associated with Special Study A: "An Ethnographic Study of the Forty Classrooms of the Beginning Teacher Evaluation Study". Twenty teachers at both the second and fifth grades - forty teachers in all - were observed for one week by an ethnographer who observed the teaching of reading and mathematics. Ethnographer field notes were dictated and transcribed into formal protocols. In addition, informal protocols were developed from informal observations such as conversations with teachers or students. The ethnographers also developed a summary profile for each classroom based on Jules Henry's "A Cross-Cultural Outline of Education". Protocols in this volume were selected from several classrooms.

Tikunoff, William J., Berliner, David C., and Rist, Ray C. Sample of Fifth Grade Classroom Protocols from Special Study A of the Beginning Teacher Evaluation Study. San Francisco, California: Beginning Teacher Evaluation Study, Far West Laboratory for Educational Research and Development, March-April 1975. (12 pages plus appendices)

Sample of Fifth Grade Classroom Protocols Collected within this volume are examples of the protocols from grade 5 developed by the ethnographers associated with Special Study A: "An Ethnographic Study of the Forty Classrooms of the Beginning Teacher Evaluation Study". Twenty teachers at both the second and fifth grades - forty teachers in all - were observed for one week by an ethnographer who observed the teaching of reading and mathematics. Ethnographer field notes were dictated and transcribed into formal protocols. In addition, informal protocols were developed from informal observations such as conversations with teachers or students. The ethnographers also developed a summary profile for each classroom based on Jules Henry's "A Cross-Cultural Outline of Education". Protocols in this volume were selected from several classrooms.

Experimental Teaching Unit: Second Grade Mathematics, San Francisco, California: Beginning Teacher Evaluation Study, Far West Laboratory for Educational Research and Development, 1974. (141 pages)

The experimental Teaching Unit is designed to provide common instructional objectives, in an area which is educationally important but not commonly covered within the curriculum to provide some consistentcy in instruction across á number of classes, while also providing sufficient flexibilitv to enable teachers to maintain their normal teaching styles. The Units contain instructional objectives and a number of teaching activities, as well as student achievement tests.

The purpose of this unit is to develop basic concepts of measurement. The child will have a variety of experiences which make measurement concepts meaningful to him. This unit will provide some review of counting skills and simple addition and subtraction skills. The primary focus, however, is to build concepts of measurement in length, weight or mass, volume or capacity, and area and extend them into a simple introduction to the metric system. Activities in each subtopic of this Experimental Teaching Unit suggest ways to accomplish that. The subtopics are: comparisons, ordering, conservation, arbitrary units of measuring, and standard units of measuring.

Experimental Teaching Unit: Second Grade Reading, San Francisco, California: Beginning Teacher Evaluation Study, Far West Laboratory for Educational Research and Development, 1974. (191 pages)

The Experimental Teaching Unit is designed to provide common instructional objectives, in an area which is educationally important but not commonly covered within the curriculum to provide some consistency in instruction across a number of classes, while also providing sufficient flexibility to enable teachers to maintain their normal teaching styles. The Units contain instructional objectives and a number of teaching activities, as well as student achievement tests.

This unit deals with important reading skills of following directions, understanding and following a sequence of actions, word structure and prefixes and suffixes.

Experimental Teaching Unit: Fifth Grade Mathematics, San Francisco, California: Beginning Teacher Evaluation Study, Development, 1974. (319 pages)

The Experimental Teaching Unit is designed to provide common instructional objectives, in an area which is educationally important but not commonly covered within the curriculum to provide some consistency in instruction across a number of classes, while also providing sufficient flexibility to enable teachers to maintain their normal teaching styles. The Units contain instructional objectives and a number of teaching activities, as well as student achievement tests.

This unit deals with the concept of probability, the use of probability to make predictions, and procedures to gather and display probability data using graphs. Fractions are used to express probabilities.

Experimental Teaching Unit: Fifth Grade Reading, San Francisco, California: Beginning Teacher Evaluation Study, Far West Laboratory for Educational Research and Development, 1974. (225 pages)

The Experimental Teaching Unit is designed to provide common instructional objectives, in an area which is educationally important but not commonly covered within the curriculum to provide some consistency in instruction across a number of classes, while also providing sufficient flexibility to enable teachers to maintain their normal teaching styles. The Units contain instructional objectives and a number of teaching activities, as well as student achievement tests.

This unit is designed to improve a student's reading comprehension by increasing his understanding of the way language works. To improve reading for meaning, the student is introduced to the concept of paraphrase. A particular idea can be stated in a number of different ways. The external form of the message can change as sentences are rewritten, but the underlying meaning stays the same. This concept of paraphrase is applied at three levels: (1) different words can be used to represent the same concept (synonyms); (2) sentences can be rewritten to express the same idea; and (3) paragraphs or stories have a major topic and can contain ideas written in different ways. Another section of the unit gives the student practice in using context clues. As a skilled reader processes a sentence, he uses his knowledge of language to make predictions about what words will appear. By integrating words into the larger unit of the sentence or paragraph, the reader can decode words with a minimum of visual cues. He relies on the redundancy of language to fill in additional features.

Phase III-A Continuation
Technical Reports and Notes

Marliave, Richard S. A Review of the Findings of Phase II. San Francisco, California: Technical Note I-1, Beginning Teacher Evaluation Study, FWL, May, 1976. (33 pages)

This document examines the implications of the Phase II report specifically for observation variables that might be used in future Beginning Teacher Evaluation Study (BTES) research, focusing on those variables and patterns of variables that showed the strongest and most consistent relationships with student learning in the Phase II report. The variables are discussed within four basic categories: 1) teacher behaviors, 2) student behaviors, 3) teacher characteristics, and 4) student characteristics. This document is written with the assumption that the reader is familiar with the design and methodology of the Phase II study. The Phase II report examines the data collection, data analysis, and conclusions of one of the most comprehensive and complex studies of teaching conducted to date.

Marliave, Richard S. Observable classroom variables. San Francisco, California: Technical Report I-2, Beginning Teacher Evaluation Study, Far West Laboratory for Educational Research and Development, July, 1976. (28 pages)

This report provides a brief review of BTES documents from Phase II and Phase III-A, including responses from nationally-known researchers suggesting variables for future BTES research. Seven basic observable classroom variable domains have been found to receive support from several of the BTES sources reviewed. These seven variable domains are: the quantity of academic instruction received by the student, the strength of the academic orientation of instruction, the extent to which instruction is tailored to the needs of individual students, the clarity of instructional communication, the teacher's instructional involvement and contact with students, student attention to the academic task, and the existence of a positive, family-like classroom atmosphere. It was also concluded that variables related to information processing by the teacher make up a domain of non-observable classroom variables. In addition, several methodological implications of the research reviewed were discussed.

Marliave, Richard. Findings of clinical field observations. San Francisco, California: Technical Note I-4, Beginning Teacher Evaluation Study, Far West Laboratory for Educational Research and Development, July, 1976. (21 pages)

This document describes the clinical observation activities in a sample of California classrooms as part of the developmental work for Phase III of the Beginning Teacher Evaluation Study. The actual observation procedures are documented and the conclusions reached on the basis of those observations are presented. Conclusions related to time-based observation of student behavior and teacher-student interaction, as well as related data collection procedures, are presented. Additional conclusions relate to the usability of rating scales, questionnaires, and interviews.

Marliave, Richard S., Fisher, Charles W., Filby, Nikola N., Dishaw, M. The development of instrumentation for a field study of teaching. San Francisco, California: Technical Report I-5, Beginning Teacher Evaluation Study, Far West Laboratory for Educational Research and Development, February 1977. (43 pages plus appendices)

This report describes time coding forms, rating scales, interview schedules, and a questionnaire, all of which are instruments designed for use in Phase III-B of BTES. The BTES developmental activities leading to the design of this instrumentation are reviewed. Design and field testing activities relevant to each instrument are also presented. Inter-observer reliability data obtained during the field test of the time coding forms are presented and discussed. In addition, all of the forms, scales, and manuals that comprise these instruments are presented in the body and the appendices of this report.

Design for a Study of Instructional Time. San Francisco, California: Technical Note II-1, Continuation of Phase III-A, Beginning Teacher Evaluation Study, Far West Laboratory for Educational Research and Development, August 15, 1975.(34 pages)

This report describes the research design for a study of instructional time, one of the research efforts of Phase III-A of the Beginning Teacher Evaluation Study. The variables to be studied, the sample, the data collection and analysis procedures are described, and a research time schedule is included. The instruments to be used in the research are described in Technical Note II-2, Instruments for the Study of Instructional Time. The results of this research effort are presented in several companion volumes, Technical Report II-3, A Study of Instructional Time in Grade 2 Mathematics; Technical Report II-4, A Study of Instructional Time in Grade 2 Reading; and Technical Report II-5, Instructional Time Allocation in Fifth Grade Reading.

Instruments for the Study of Instructional Time. San Francisco, California: Technical Note II-2, Beginning Teacher Evaluation Study, Far West Laboratory for Educational Research and Development, August 15, 1975. (38 pages)

This document describes the instruments, and the development of the instruments, for recording of teacher time allocation (teacher logs) and classroom observation for the study of instructional time in Phase III-A of the Beginning Teacher Evaluation Study (BTES). The research design for the study is presented in Technical Note II-1, Design for a Study of Instructional Time. The data collection procedures and instruments are the result of research efforts conducted in earlier Phases of the BTES and this development is chronicled in this Technical Note.

Karnischfeger, Annegret and Wiley, David E. Notes for a field study of instructional time. San Francisco, California: Technical Report 75-10-11, Beginning Teacher Evaluation Study, Far West Laboratory for Educational Research and Development, October, 1975. (33 pages)

This paper follows up on an early report which presented a theory on instructional processes that relied on a time metric. In this paper a design for field studied within this theoretical orientation is presented. Methods to obtain information on how teachers allocate time so that grouping and individualization strategies can be studied are discussed. Sampling procedures for observations are recommended, and a data file structure for this kind of information is explained.

Fisher, Charles W., Marliave, Richard S., Filby, Nikola N., Cahen, Leonard S., Moore, Jeffrey E., and Berliner, David C. A study of instructional Time in grade 2 mathematics. San Francisco, California: Technical Report II-3, Beginning Teacher Evaluation Study, Far West Laboratory for Educational Research and Development, 1976. (159 pages)

This report contains the results of a field study of the relationship between instructional time and student achievement. Quantities of time allocated to mathematics content categories and instructional settings are described for a forty-day instructional period. Descriptions of student 'engaged time' for a ten-day period are also included. The data were collected in six grade 2 classrooms. Relationships between both allocated time and engaged time in specific mathematics content categories and achievement in those content categories were investigated. Large differences were found in the amounts of time allocated to mathematics content categories. Large differences were also found in the amounts of time students were engaged in instructional activities. Positive relationships were found between amount of instruction and student achievement.

Fisher, Charles W., Filby, Nikola N., Marliave, Richard S., Cahen, Leonard S., Moore, Jeffrey E., and Berliner David C. A study of instructional time in grade 2 reading. San Francisco, California: Technical Report II-4, Beginning Teacher Evaluation Study, Far West Laboratory for Educational Research and Development, 1976. (133 pages plus appendix)

This report contains the results of a field study of the relationship between instructional time and student achievement. Quantities of time allocated to reading categories and instructional settings are described for a forty-day instructional period. Descriptions of student "engaged time" for a ten-day period are also included. The data were collected in nine grade 2 classrooms. Relationships between both allocated time and engaged time in specific reading content categories and achievement in those content categories. Large differences were also found in the amounts of time students were engaged in instructional activities. Positive but relatively weak relationships were found between amount of instruction and student achievement.

Instructional Time Allocation in Fifth Grade Reading. San Francisco, California: Technical Report II-5, Beginning Teacher Evaluation Study, Far West Laboratory for Educational Research and Development, December, 1976. (53 pages plus appendices)

This report describes the naturally occurring variations in time allocated to reading instruction in a sample of grade five classes selected as part of the Beginning Teacher Evaluation Study. Students completed a set of reading tests in early and late fall and teachers maintained records of instructional time allocated, setting, and content covered, for the students. Ceiling effects in the reading tests precluded an analysis of the relationship of time to achievement. The time data were analyzed to identify variations across classes and differences among students within a class in terms of allocated time to instructional settings and content areas.

Filby, Nikola N. and Dishaw, Marilyn. Development and refinement of reading and mathematics tests for grades 2 and 5. San Francisco, California: Technical Report III-1, Beginning Teacher Evaluation Study, Far West Laboratory for Educational Research and Development, 1975. (213 pages, plus Appendix C, mathematics items, and Appendix D, reading items, which are bound separately)

This report describes initial and future plans to develop tests that are maximally sensitive to instruction. Two important issues to address are the content coverage of the tests (opportunity to learn) and the reactivity of the measure to instruction. The ability of students must be minimally related to change in performance, and when the opportunity-to-learn is high, that factor must be maximally related to performance in order to have a test that is useful in studies of teaching. An ability by opportunity-to-learn matrix is constructed for every item in the battery of reading and mathematics tests used in second and fifth grade in order to develop as sensitive a test as possible for the study of teaching. These procedures are described in this report.

Design for use of individual testing in the study of instructional time. San Francisco, California: Technical Note III-2, Beginning Teacher Evaluation Study, Far West Laboratory for Educational Research and Development, September, 1975. (12 pages)

This report describes the general plan for a study to clarify the interpretation of group performance measures of student achievement. Group tests are the most efficient procedure for collecting achievement information from a large number of students, but they also require item formats which may be different from the form in which students normally demonstrate or apply their learning. To provide information about some of these potention differences, to be used in the interpretation of group test scores, two studies are planned, one of second grade students in the areas of reading and mathematics, and one of second and fifth grade students in reading comprehension.

Instruments for Individual Assessment of Achievement. San Francisco, California: Technical Note III-3, Beginning Teacher Evaluation Study, Far West Laboratory for Educational Research and Development, September 15, 1975. (15 pages)

One task of the Beginning Teacher Evaluation Study was to develop and refine student achievement tests. Individual testing was conducted to provide input information relative to the group achievement tests. This technical note describes the materials and the procedures used for the individual student testing.

Filby, Nikola N. and Dishaw, Marilyn M. Construct Validation of Group-Administered Achievement Tests through Individual Testing. San Francisco, California: Technical Note III-4, Beginning Teacher Evaluation Study, Far West Laboratory for Educational Research and Development, April, 1977. (62 pages plus appendices)

This report describes part of the work done to develop student achievement tests in reading and mathematics for use in Phase III-B of the Beginning Teacher Evaluation Study. While the achievement battery consists primarily of group-administered multiple-choice test items, several individual-tesing studies were conducted to examine the validity of group-test measures and to gain insight for the improvement of group-test items. The sample of students, data collection and analysis procedures, and results and conclusions are presented. The actual revisions in the test battery which resulted from this effort are described in Technical Report III-6, Refinement of Reading and Mathematics tests through an Analyses of Reactivity.

Filby, Nikola N. Progress report on reactivity analyses (October - December test data). San Francisco, California: Technical Note III-5, Beginning Teacher Evaluation Study, Far West Laboratory for Educational Research and Development, April 30, 1976. (16 pages)

This report summarizes the procedures used to collect and analyze data to evaluate the degree to which test items are reactive to instruction. This progress report describes actual steps conducted to complete the study described in Technical Report III-1, Development and Refinement of Reading and Mathematics Tests for Grades 2 and 5 of the Beginning Teacher Evaluation Study. The results of these analyses are described in Technical Report III-6, Refinement of Reading and Mathematics Tests through an Analysis of Reactivity.

Filby, Nikola N. and Dishaw, Marilyn. Refinement of reading and mathematics tests through an analysis of reactivity. San Francisco, California: Technical Report III-6, Beginning Teacher Evaluation Study, Far West Laboratory for Educational Research and Development, 1976. (57 pages plus appendices)

This report follows up Technical Report III-1 and describes major analyses of test reactivity to instruction. Year-long teacher records were used to determine opportunity-to-learn. An ability by opportunity-to-learn matrix is reported for each subtest. Item reactivity is also reported. Test revisions, as dictated by reactivity analyses and other pilot test data, are summarized. The report compares reactivity analysis to standard psychometrics as a method of producing tests which are sensitive measures of classroom learning.

Marliave, Richard, Cahen, Leonard S., and Berliner, David C. Prolegomenon on the concept of appropriateness of instruction. San Francisco, California: Technical Report IV-1, Phase III-A Continuation, Beginning Teacher Evaluation Study, Far West Laboratory for Educational Research and Development, July, 1977. (14 pages)

This report discusses the question of the appropriateness of teacher behaviors in relation to both the counting of frequencies of teacher behaviors and the interpretation of the impact of teacher behaviors on student learning. The recent focus, in research on teaching, on the counting of teacher behaviors gives rise to a concern for the meaning, as well as the frequency, of teacher behaviors. The report describes three different definitions of appropriateness and the related systems for measuring teacher behaviors. The first definition considers appropriateness in terms of teacher decision making; the second in terms of teacher behavior in classroom settings; the third in relation to Academic Learning Time.

Filby, Nikola N. Plans for further development of experimental teaching units. San Francisco, California: Technical Note V-2, Beginning Teacher Evaluation Study, Far West Laboratory for Educational Research and Development, March, 1976.(7 pages)

The report describes the problems related to control of or variety in curriculum in studies of teaching and the procedures used in one Phase of the Beginning Teacher Evaluation Study to control to some extent the curriculum in reading and mathematics. The major focus of the document is the plan for further study of aspects of Experimental Teaching Units designed to provide varying degrees of control of curriculum to facilitate research on teaching.

Filby, Nikola N. Theoretical and empirical consideration of design issues related to experimental teaching units. San Francisco, Calif.: Technical Note V-3 for Phase III-A Continuation, Beginning Teacher Evaluation Study, Far West Laboratory for Educational Research and Development, June, 1977. (13 pages)

This Technical Note discusses some theoretical and empirical issues that influenced the selection of a research design for the major field study carried out in Phase III-B of BTES. One line of research in the hypothesis-generation phase of the study used an Experimental Teaching Unit (LTU) to create a semi-standardized situation for comparison of teachers. Another line of research focused on naturally-occurring behavior, particularly instructional time. In the instructional time framework, a different research design was used, involving an "objectives-only" ETU. As plans were made for the major field study, design issues were reconsidered. Technical Note V-2, Plans for Further Development of Experimental Teaching Units, stated the need to reconsider the reasons for an experimental teaching unit and to evaluate the alternative design approaches that had been used thus far. This Technical Note reviews and discusses issues of research design, presents data from alternative approaches, and draws conclusions for the Phase III-B design.

Phase III-B
Technical Reports and Notes

Howell, W. Pearl and Rice, Carol F. Field Coordination Phase III-B Beginning Teacher Evaluation Study. San Francisco, California: Technical Note II-1, Beginning Teacher Evaluation Study, Far West Laboratory for Educational Research and Development, July, 1977. (23 pages plus appendices)

This technical report gives an overview of coordination activities that occurred during the data collection for Phase III-B of the Beginning Teacher Evaluation Study. A history of the recruitment, selection, and training of field personnel, a description of coordination efforts with teachers and school districts, a discussion of the various aspects of scheduling, and a discussion of procedures for logging-in and checking the quality of the field data are presented. Each major section of the report summarizes in sequence the tasks required for collection of the field data and provides supporting documents. Other tasks during the data collection phase, such as log training for teachers, instrumentation development, and observation training are presented in other BTES technical notes and reports.

Cahen, Leonard S. The Development of a Selection Battery for Phase III-B. San Francisco, California: Technical Note III-1, Beginning Teacher Evaluation Study, Far West Laboratory for Educational Research and Development, November 30, 1976. (18 pages)

This report describes the development of a Selection Battery for choosing target students for Phase III-B of the Beginning Teacher Evaluation Study. A discussion of the reasons for selecting target students for intensive classroom observation precedes the description of procedures used to select from the larger test battery a sample of test items to form the Selection Battery. A second report (Technical Note III-1, Part II) describes the procedures actually used for selecting target students from among the students to whom the Selection Battery was administered.

Cahen, Leonard S. Selection of Second and Fifth Grade Target Students for Phase III-B. San Francisco, California: Technical Note III-1 (Part II) Beginning Teacher Evaluation Study, Far West Laboratory for Educational Research and Development, January, 1977. (18 pages)

The actual selection of target students from second and fifth grade classrooms, from the group of students to whom the Selection Battery was administered, is described in this report, including the statistical procedures and cut-off scores. A companion report (Technical Note III-1, The Development of a Selection Battery for Phase III-B, Leonard S. Cahen) describes the procedures for developing the Selection Battery from the full battery of student achievement tests, as well as the reasons for using a sample of target students, selected on the basis of achievement, for intensive classroom observation as part of the data collection for one Phase of the Beginning Teacher Evaluation Study.

Cahen, Leonard S. Report on "A" Testing. San Francisco, Calif.: Technical Note III-2, Beginning Teacher Evaluation Study, Far West Laboratory for Educational Research and Development, December 23, 1976. (8 pages)

This document describes the "A" testing, Phase III-B of the Beginning Teacher Evaluation Study, which took place in October, 1976. A sample of target students, 6 per class, in a sample of second and fifth grade classes in California completed the achievement battery in reading and mathematics. Administration procedures, results, and psychometric properties of the tests are described.

Cahen, Leonard S. Report of "B" Testing. San Francisco, Calif.: Technical Note III-3, Beginning Teacher Evaluation Study, Far West Laboratory for Educational Research and Development, February 25, 1977. (9 pages)

This document describes the "B" testing, Phase III-B of the Beginning Teacher Evaluation Study, which took place in December 1976. A sample of target students, 6 per class, in a sample of second and fifth grade classes in California completed the achievement battery in reading and mathematics. Administration procedures, results, and psychometric properties of the tests are described. This is a companion document to Technical Note III-2, Report of the "A" Testing.

Cahen, Leonard S. Report of "C" Testing. San Francisco, Calif.: Technical Note III-4, Beginning Teacher Evaluation Study, Far West Laboratory for Educational Research and Development, June, 1977. (11 pages)

This document describes the "C" testing, Phase III-B of the Beginning Teacher Evaluation Study, which took place in May 1977. A sample of target students, 6 per class, in a sample of second and fifth grade classes in California completed the achievement battery in reading and mathematics. Administration procedures, results, and psychometric properties of the tests are described. This is a companion document to Technical Note III-2, Report of the "A" and "B" Testings.

Cahen, Leonard S. Report on "D" Testing. San Francisco, California: Technical Note III-5, Beginning Teacher Evaluation Study, Far West Laboratory for Educational Research and Development, October, 1977. (11 pages)

This document describes the "D" testing, Phase III-B of the Beginning Teacher Evaluation Study, which took place in September 1977. A sample of target students six per class, in a sample of second and fifth grade classes in California completed the achievement battery in reading and mathematics. Administration procedures results, and psychometric properties of the tests are described. This is a companion document to Technical Note III-2, Report of the "A" Testing, Technical Note III-3, Report of the "B" Testing, and Technical Note III-4, Report of the "C" Testing.

Filby, Nikola N. and Marliave, Richard. Descriptions of Distributions of ALT Within and Across Classes During the A-B Period. San Francisco, California: Technical Note IV-1a, Beginning Teacher Evaluation Study, Far West Laboratory for Educational Research and Development, September, 1977. (44 pages)

This report provides descriptive statistical information from Phase III-b of the Beginning Teacher Evaluation Study, being conducted by the Commission for Teacher Preparation and Licensing. Within the sample of second and fifth grade classrooms in public schools in California, approximately six students were identified as target students to be studied during the school year. These students were observed approximately weekly during the period from October to December and again during the period from January to May. The observers recorded student time within subject matter areas of reading and mathematics, focusing on the content of student instructional tasks, the degree of difficulty of instructional tasks for individual students, and student engagement on those tasks. ALT (Academic Learning Time) is defined as time on tasks of intermediate difficulty for the student directly related to the measures of achievement under study during which a student is engaged in the instructional task. The report provides descriptive information on ALT for individuals within classes and comparisons across classes for the period from October to December during the 1976-77 school year.

Fisher, Charles W., Filby, Nikola N., and Marliave, Richard S. Descriptions of Distributions of ALT Within and Across Classes During the B-C Period. San Francisco, California: Technical Note IV-1b, Beginning Teacher Evaluation Study, Far West Laboratory for Educational Research and Development, October, 1977. (49 pages)

This report provides descriptive statistical information from Phase III-B of the Beginning Teacher Evaluation Study, being conducted by the Commission for Teacher Preparation and Licensing. Within the sample of second and fifth grade teachers in classrooms in public schools in California, approximately six students were identified as target students to be studied during the school year. These students were observed approximately weekly during the period from January to May. The observers recorded student time within subject matter areas of reading and mathematics, focusing on the content of student instructional tasks, the degree of difficulty of instructional tasks for individual students, and student engagement on those tasks. ALT (Acedemic Learning Time) is defined as time on tasks of intermediate difficulty for the student, directly related to the measures of achievement under study, during which a student is engaged in the instructional task. The report provides descriptive information on ALT for individuals within classes and comparisons across classes for the period from January to May during the 1976-77 school year.

Dishaw, Marilyn. Descriptions of Allocated Time to Content Areas for the A-B Period. San Francisco, Calif.: Technical Note IV-2a, Beginning Teacher Evaluation Study, Far West Laboratory for Educational Research and Development, July, 1977. (42 pages plus appendices)

This report provides descriptive data on allocated time in reading and mathematics for grades 2 and 5 as reported by a sample of California teachers participating in one Phase of the Beginning Teacher Evaluation Study. The procedures used by teachers to record information are described and data are presented for the A-B period, October to December. Class means are provided on the amount of time accumulated over the A-B period in specific content categories. Daily means and the mean percent of total time allocated to specific content areas are also presented, along with teacher estimates of task difficulty. A companion report (Technical Note IV-2b, Descriptions of Allocated Time to Content Areas for the B-C Period, Marilyn Dishaw) presents comparable data for the school year from January to May (1976-77).

Dishaw, Marilyn. Descriptions of Allocated Time to Content Areas for B-C Period. San Francisco, Calif.: Technical Note IV-2b, Beginning Teacher Evaluation Study, Far West Laboratory for Educational Research and Development, August, 1977. (31 pages)

This report describes the allocation of time in reading and mathematics to specific content categories in a sample of second and fifth grade classes, as reported by teachers participating in one Phase of the Beginning Teacher Evaluation Study. Class means are provided in the amount of time accumulated over the period from January to May. Daily means and the mean percent of total time allocated to specific content areas are also presented, along with teacher estimates of task difficulty. A companion report (Technical Note IV-2a, Descriptions of Allocated Time to Content Areas for the A-B Period, Marilyn Dishaw) describes the data collection procedures and presents data from October to December of the same school year (1976-77).

Filby, Nikola N. Description of Patterns of Teaching Behavior within and Across Classes During the A-B Period. San Francisco, California: Technical Note IV-3a, Beginning Teacher Evaluation Study, Far West Laboratory for Educational Research and Development, October, 1977. (54 pages)

This document provides a description of the data collection procedures and the results of data collection for observation of teaching behaviors in the sample classrooms in Phase III-B of the Beginning Teacher Evaluation Study, being conducted by the Far West Laboratory for the Commission for Teacher Preparation and Licensing. During the 1976-77 school year, the behaviors of the teachers within the Phase III-B sample were observed approximately once each week for the entire school day, with the observations focusing on the teaching of reading and mathematics. A sample of approximately six students were selected in each classroom as the focus of observation. Any behaviors of teachers directed toward these students, either individually or as members of groups, were recorded by the observers. The data were summed for the period from October to December of the school year, covering approximately seven weeks of observations, and are presented by class as well as summed for all classes within the study.

Filby, Nikola, N., and Fisher, Charles W. Description of Patterns of Teaching Behavior Within and Across Classes During the B-C Period. San Francisco, California: Technical Note IV-3b, Beginning Teacher Evaluation Study, Far West Laboratory for Educational Research and Development, October, 1977. (54 pages)

This document provides a description of the data collection procedures and the results of data collection for observation of teaching behaviors in the sample classrooms in Phase III-b of the Beginning Teacher Evaluation Study, being conducted by the Far West Laboratory for the Commission for Teacher Preparation and Licensing. During the 1976-77 school year, the behaviors of the teachers within the Phase III-B sample were observed approximately once each week for the entire school day, with the observations focusing on the teaching of reading and mathematics. A sample of approximately six students, either individually or as members of groups, were recorded by the observers. The data were summed for the period from January to May of the school year, covering approximately 15 weeks of observations, and are presented by class as well as summed for all classes within the study.

Marliave, R.S., Fisher, C.W., and Dishaw, M.M. Academic learning time and student achievement in the A-B period (Technical Note V-1a). Beginning Teacher Evaluation Study (Phase III-B), Far West Laboratory for Educational Research and Development, 1977, 135 pp.

Marliave, R.S, Fisher, C.W., and Dishaw, M.M. Academic learning time and student achievement in the B-C period (Technical Note V-2a). Beginning Teacher Evaluation Study (Phase III-B), Far West Laboratory for Educational Research and Development, 1978, 129 pp.

Filby, N.N. and Cahen, L.S. Teaching behavior and academic learning time in the A-B period (Technical Note V-1b). Beginning Teacher Evaluation Study, Far West Laboratory for Educational Research and Development, San Francisco, 1977, 82 pp.

Filby, N.N. and Cahen, L.S. Teaching behavior and academic learning time in the B-C period (Technical Note V-2b). Beginning Teacher Evaluation Study, Far West Laboratory for Educational Research and Development, San Francisco, 1978, 91 pp.

Berliner, David C., Filby, Nikola N., Marliave, Richard S., Weir, Christina D., Fisher, Charles W. Description of Classes and Plan for an Intervention Study. San Francisco, California: Technical Note VI-1, Beginning Teacher Evaluation Study, Far West Laboratory for Educational Research and Development, December, 1976. (31 pages)

This technical note contains sections on the philosophy of the intervention study, the procedures and methodology to be used, the history of selection of classes, the instructional model, and examples of possible interventions in classes selected for inclusion in the intervention study in Phase III-B of the Beginning Teacher Evaluation Study. A final section, titled Summary Comments, contains the three major recommendations of the Commission's Research Advisory Board who reviewed this document. The study focusses on the process of change in teacher and student behaviors in classrooms.

Berliner, D.C., Filby, N.N., Marliave, R.S., and Weir, C.D. An intervention in classrooms using the Beginning Teacher Evaluation Study model of instruction (Technical Report VI-1). Beginning Teacher Evaluation Study, Far West Laboratory for Educational Research and Development, San Francisco, 1978, 228 pp.

Fisher, C.W., and Berliner, D.C. Quasi-clinical inquiry in research on classroom teaching and learning (Technical Report VI-2). Beginning Teacher Evaluation Study (Phase III-B), Far West Laboratory for Educational Research and Development, 1977, 25 pp.